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The Federal Fisheries Service, 1871–1940: Its Origins, Organization, and Accomplishments

THEODORE WHALEY CART

Introduction

The Declaration of Independence does not include the pursuit of fish as one of the unalienable rights of men to be secured by government, nor does the U.S. Constitution specify the regulation and preservation of the nation's fishery resources as an enumerated power of Congress. When those documents were drawn the right of the individual to take wild creatures for food, pleasure, and profit was not questioned, and an

abundance of fish and game precluded concern for conserving what appeared to be an inexhaustible resource. It is a fact, nevertheless, that the funds and energy of the Federal government were applied to fishery problems as early as the Treaty of Paris in 1783 [which ended the Revolutionary War] and have continued to be so employed up to the present day.

Fishery Concerns

Federal concern for fishery problems arose initially to assure fishing rights to U.S. citizens in international waters and, subsequently, to preserve and maintain fishery resources from depletion by both human and natural agents. In advocating international fishing rights, the responsibility of the Federal government was thus discharged through the Department of State. The need for fishery conserva-

tion was not officially recognized at the Federal level until 1871, when the U.S. Fish Commission (USFC) was created to inquire into an apparent decline in the country's fishery resources¹ (U.S. Congress, 1871). Since 1871, reactions to both needs have been combined within a complex of legal restraints.

Fishery Conservation

The Federal government has achieved substantial influence over the nation's approach to fishery conservation despite the undisputed legal jurisdiction of the states over the regulation of fish and wildlife within their borders. In the international area the constitutional authority for Federal fishery regulation is clearly implicit in the specified powers to make treaties and to regulate commerce with foreign nations. In justifying national jurisdiction the government has relied as well upon broad construction of its enumerated powers to regulate interstate commerce, to administer the territory and other property of the United States, and to raise money by taxation to be spent for the general welfare (Connery, 1935).

The most significant Federal contribution has been the work of the Fisheries Service. The concept, spirit, and accomplishments of this agency have been indications as well as guides of state and public attitudes toward the problems of fishery conservation. Of course, the public's awareness that the only alternative to fishery regulation was fishery destruction would have occurred without Federal participation.

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ABSTRACT—The U.S. Fish Commission was initiated in 1871 with Spencer Fullerton Baird as the first U.S. Fish Commissioner as an independent entity. In 1903 it became a part of the new U.S. Department of Commerce and Labor and was renamed the Bureau of Fisheries, a name it retained when the Departments of Commerce and Labor were separated in 1912. The Bureau remained in the Commerce Department until 1941 when it was merged with the Biological Survey and placed in the Department of Interior as the U.S. Fish and Wildlife Service. It was a scientific agency with well conceived programs of action, and it provided knowledge, advice, and example to state governments and individuals with fisheries interests and needs. Its efforts were supported by timely international agreements which constituted the precedent for Federal interest in fishery matters. The Fisheries Service earned stature as an advisor through heavy emphasis on

basic biological research. The lack of such knowledge was marked and universal in the 1870's, but toward the end of that decade, strong steps had been taken to address those needs under Baird's leadership.

USFC research activities were conducted cooperatively with other prominent scientists in the United States and abroad. Biological stations were established, and the world's first and most productive deep-sea research vessel, the Albatross, was constructed, and its 40-year career gave a strong stimulus to the science of oceanography. Together, the agency's scientists and facilities made important additions to the sum of human knowledge, derived principles of conservation which were the vital bases for effective regulatory legislation, conducted extensive fish cultural work, collected and disseminated fisheries statistics, and began important research in methods of fish harvesting, preservation, transportation, and marketing.

¹The official title was U.S. Commission of Fish and Fisheries, but it was regularly called just the U.S. Fish Commission (USFC). Cart preferred to term it the "Fisheries Service."

United States Fish Commissioners



Spencer Fullerton Baird
1871–1887



George Brown Goode
1887–1888



Marshall McDonald
1888–1895



Herbert A. Gill (Acting)
1895–1896



John J. Brice
1896–1898



George M. Bowers
1898–1913



Hugh M. Smith
1913–1922



Henry O'Malley
1922–1933



Frank T. Bell
1933–1939



Charles Jackson (Acting)
1939–1940



Ira N. Gabrielson
1940–1946

Photo sources: Baird, Goode, McDonald, Brice, and Bowers (U.S. Department of Commerce and Labor, 1908); Gill courtesy of the Gill family; Smith, O'Malley, and Gabrielson courtesy of the Library of Congress; Jackson courtesy of the U.S. Fish and Wildlife Service; and Bell courtesy of and copyrighted by The Seattle Times.

The combined effects of technology, industrialization, and population growth to intensify fishing methods and pollute streams and lakes would have delivered the message unaided, and, in most instances, without leaving time for effective preventive action.

USFC Organization and Accomplishments

The first purpose of this study is to describe the organization and activities of the Federal Fisheries Service from the appointment of Spencer Fullerton Baird as the first United States Commissioner of Fish and Fisheries in 1871 to the implementation of the reorganization plan in 1940, a plan that blended Federal conservation services for both aquatic and terrestrial wildlife resources into a single administrative framework.

The second purpose is to appraise the accomplishments of the Fisheries Service and to test the validity of the statement by Rep. John F. Benjamin (R-Mo.) during the House debate on the original enabling legislation. As Rep. Benjamin put it: "If this joint resolution be passed there will be no end to the expenditure of public money . . . before we get through with it" (Congressional Globe, 1871).

The Federal Fisheries Service has carried three titles and undergone two fundamental organizational changes during the 70 years under review. From 1871 to 1903 the Service was formally termed the United States Commission of Fish and Fisheries and informally called the "Fish Commission." The Fish Commission was independent of any of the regular executive departments of the government during those years, although for accounting purposes its appropriations were carried under the heading of the Department of the Treasury.

In 1903 the title was changed to the Bureau of Fisheries, and, as such, it became a self-contained administrative unit of the Department of Commerce and Labor which was newly organized that year (U.S. Congress, 1903). In 1912, when the Departments of Commerce and Labor were separated, the

Bureau of Fisheries remained within the Department of Commerce.

The third change occurred in 1939 when the Bureau was transferred intact to the Department of the Interior and merged with the old Bureau of Biological Survey under the title Fish and Wildlife Service (U.S. Congress, 1939a, b).² Such a typically complicated catalog of bureaucratic modifications obscures the important central fact that the basic purposes and activities of the Federal Fisheries Service remained remarkably constant over the 70-year span from 1871 to 1940.

Secretary of the Interior Harold L. Ickes succinctly described the Fish and Wildlife Service on its first birthday as "fundamentally a fact finding agency" and a group of "scientific bureaus with action programs" (U.S. Department of the Interior, 1941). The first U.S. Commissioner of Fish and Fisheries, Spencer Fullerton Baird, would have emphatically agreed with him.

Commissioner Baird

To account for the stability of the goals and functions of the Service it is necessary to become acquainted with Professor Baird and to understand the circumstances surrounding the establishment of the Fish Commission. Baird's concept of the role of the Federal government in maintaining and preserving the fishery resources of the country stressed biological and oceanographical research, artificial propagation, and the compilation and use of fisheries statistics. It was a concept unusually advanced for its time and persisted with only minor changes in emphasis resulting from variations in leadership, the addition of executive duties with the advent of direct regulation of the Alaska fisheries, and the special demands of World War I and the Great Depression.

² In 1956 the Fish and Wildlife Service was further subdivided to comprise the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries (BCF) (84th Congr.). [The BCF eventually was renamed the National Marine Fisheries Service and placed in the National Oceanic and Atmospheric Administration in 1970, again back under the Department of Commerce.]



Joseph Henry,
courtesy of the Library of Congress.

The coincidence of two formidable forces, one natural, the other human, on the New England coast in the late 1860's led to Baird's appointment as U.S. Fish Commissioner in 1871. The natural force was an apparent sharp diminution of the inshore fisheries which had progressed over the decade to the point where controlling the pound nets and fish traps that dotted the river mouths and estuaries became a heated issue in the Massachusetts and Rhode Island legislatures during the winter of 1869-70. The human force was Professor Baird.

Smithsonian Work

An enthusiastic and competent naturalist, Baird had been indirectly in the employ of the Federal government since 1850 when, at age 27, he was hired by the first Secretary of the Smithsonian Institution, Joseph Henry, to the new post of Assistant Secretary. His annual salary was \$1,500, a "considerable advance" over his pay as a Professor of Natural History at Dickinson College in Carlisle, Pa. His subsequent achievements on behalf of science and the nation were impressive, even though "the country at large was not educated to the point of appreciating the importance of science, and especially of pure science" (Dall, 1915).

In assessing the impact of Professor Baird on the Fish Commission, it is important to realize that the major portion of his time was given to the Smithsonian Institution and especially to the collection of natural history specimens for the national collection. Although he held the office of Commissioner of Fish and Fisheries until his death in 1887, he considered the work subordinate to his duties at the Smithsonian, particularly after he succeeded Henry as Secretary in 1878 and while he was the active director of the National Museum from 1872 until 1886. Further indicating his feeling that his duties as Fish Commissioner were peripheral was his insistence that no salary be attached to the post, a stipulation of the law that required modification after his death. His daughter Lucy referred to the Fish Commission's annual expeditions to the New England coast as "summer campaigns."³

Fishery Issues

Baird's awareness of the perceived serious depletion of the food fishes of the New England coast grew steadily from his first specimen-collecting expedition to Woods Hole, Mass., in 1863. In the summer of 1869 his collecting program led him to Eastport, Maine, where the universal complaints of local fishermen intensified his search for a solution. The following year he persuaded Professor Henry to allocate \$100 of Smithsonian funds for study purposes and was able to borrow a 30-ft revenue sloop from the Treasury Department to inaugurate an investigation.

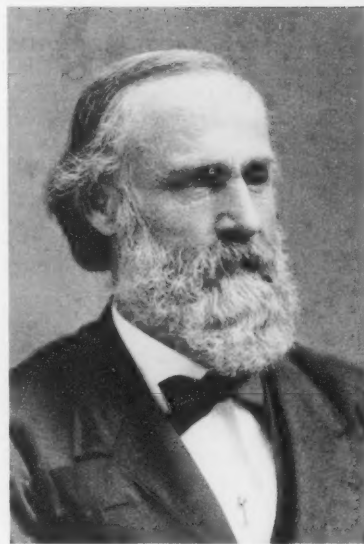
Conferences with Congressional friends from New England followed this meager but historically significant investment of Federal funds, and during the winter he drew a plan for an effective Federal inquiry which was subsequently authorized by Congress. He considered that \$5,000 would be sufficient for investigations that "... would have to be carried on at several points on the coast ... and require several years

for their completion"⁴ (Dall, 1915). The joint Congressional resolution which embodied his plan for the Fish Commission also required "all necessary and practicable aid" from the regular executive departments of the government, an injunction that Baird fully and tactfully exploited (U.S. Congress, 1871).

In a letter read into the record by Rep. Henry L. Dawes (R-Mass.), who introduced the resolution in the House of Representatives on 23 January 1871, Baird made a strong case for a Federal inquiry. He reviewed the interstate legislative impasse in which a Massachusetts legislative committee saw "no reason to interfere with the nets" while similar committees in Rhode Island and Connecticut "recommended their immediate and peremptory removal." Citing also "the impression that seems to prevail with many" that legislation "must be provided for, in part at least, by the General Government, which controls the waters in which the fish are captured," Baird went on to suggest the appointment of a Federal Fish Commissioner. The Commissioner's duties would be to prosecute the investigation, report to Congress, and "... perhaps, after conference with the Fish Commissioners of the several states, advise what action, if any, should be taken by the General Government alone or in conjunction with the states ..." (Congressional Globe, 1871).

The complex scientific basis of the inquiry was stressed in the same letter:

"Before, intelligent legislation can be initiated, however, and measures taken that will not unduly oppress or interfere with interests already established, it is necessary that a careful, scientific research be entered upon, for the purpose of determining what should really be done; since any action presupposes a knowledge of the history and habits of the fish of our coast, that, I am sorry to say, we do not at present possess. We must ascertain



Rep. Henry L. Dawes (R-Mass.), courtesy of the Library of Congress.

... at what time the fish reach our coast, and during what periods they remain; when they spawn and where; what is the nature of their food; what localities they prefer; what agencies interfere with the spawn or the young fish; what length of time elapses before the young themselves are capable of reproducing; for how many years the function of reproduction can be exercised; and many other points of equal importance" (Congressional Globe, 1871).

When the joint resolution was signed by President Grant on 9 February 1871, its language gave Professor Baird almost precisely what he had asked for. The President was "authorized and required" to appoint a Commissioner of Fish and Fisheries from among the civil officers or employees of the government to serve without salary and to be "of proved scientific and practical acquaintance with the fishes of the coast." It was tacitly understood that Baird was to be appointed commissioner, and the requirement for a man of scientific training was intended to prevent the position from becoming a political plum in the future (U.S. Congress, 1871).

³Quoting from unpublished reminiscences of Spencer F. Baird's only child, Lucy Hunter Baird, who died in 1913.

⁴Quoting a letter from Spencer F. Baird to Hon. H. L. Dawes, 15 December 1870.



President Ulysses S. Grant,
courtesy of the Library of Congress.

Commissioner's Duties

The joint resolution described the duties of the Commissioner as follows:

"... to prosecute investigations and inquiries on the subject, with the view of ascertaining whether any and what diminution in the number of the food fishes of the coast and lakes of the United States has taken place; and, if so, to what causes the same is due; and, also, whether any and what protective, prohibitory, or precautionary measures should be adopted in the premises, and to report upon the same to Congress" (U.S. Congress, 1871).

The only noticeable alteration from Baird's outline was the inclusion of the lakes of the United States, an addition representing a valid concern for the condition of the substantial Great Lakes fisheries. The measure had passed both houses of Congress with small objection. During the perfunctory and off-hand debate which preceded this action, the Representative of one land-locked state typified the opposition when he suggested a resolution on grasshoppers and potato bugs as well (Congressional Globe, 1871).⁵

Marine Science Research

The Federal government was thus committed to a program of formal research in the interest of preserving the nation's dwindling fisheries resources, the first and most fundamental of the three major activities that were to give continuity to the work of the Fisheries Service during a period of 70 years. The other two were soon to follow. They were the artificial propagation of fish (fish culture) and the compilation of the statistics and methods of the nation's fisheries. The compilation of statistics and evaluation of fishing methods were necessary corollaries to the basic inquiry authorized by Congress. The artificial propagation of food and game fishes at Federal expense, on the other hand, was of arguable utility in view of doubts concerning its effect and the potential of state programs. It depended upon the lobbying efforts of a private organization for its adoption and upon proof of performance by the Fish Commission for its continuation.

Fish Culture

The primary thrust for adding propagation to the duties of the Fisheries Service came from members of the American Fish Culture Association (AFCA). This enthusiastic group, comprising avid sport fishermen and private fish hatchery operators, had supported Baird from the beginning of his efforts to create the Federal inquiry. Recognizing the potential of the Federal government for overcoming the provincial rivalries of the states in fishery matters, the AFCA was convinced that Federal fish propagation efforts in the rivers and on the coasts shared by the states could maintain and even increase the shrinking supply of commercial and game fish there. Once the Fish Commission was created, the AFCA moved swiftly to acquaint Congress with its plan.

Meeting in Albany, N.Y., in February of 1872, and assured of the support of Professor Baird, the AFCA appointed

⁵Remarks in opposition to the joint resolution (H.R. No. 468) by Rep. John F. Fairnsorth (R-Ill.).



Rep. Robert B. Roosevelt (D-N.Y.),
courtesy of the Library of Congress.

George Shepard Page chairman of a committee to put the matter before Congress (U.S. Commission of Fish and Fisheries, 1874). The case for propagation was ably presented to the House by Rep. Robert B. Roosevelt (D-N.Y.), in a comprehensive and lengthy address delivered on 13 May 1872. Roosevelt, who was then also the New York state Fish Commissioner, concluded that propagation in waters shared by the states "... is the nation's duty or it is nobody's" (Congressional Globe, 1872). Although an initial \$10,000 request for propagation was denied by the House, the assistance of Baird's close friend Sen. George F. Edmunds (R-Vt.) and others resulted in the approval of a \$15,000 allocation in June and another for \$10,000 in fiscal year 1873 (U.S. Congress, 1872, 1873).

The fish propagation appropriations were more than three times the amount assigned to the basic inquiry and foreshadowed the continuing position of fish culture work as the most costly operation of the Federal Fisheries Service. Given the generally inadequate state conservation laws of those years, the expense was justified on the basis "... that it is better to expend a small amount of public money in making fish



Sen. George F. Edmunds (R-Vt.),
courtesy of the Library of Congress.

so abundant that they can be caught without restriction, and serve as cheap food for the people at large, rather than to expend a much larger amount in preventing the people from catching the few that still remain after generations of improvidence" (Goode, 1884).

The scramble for "free" fish after the Federal program was established is one of the less favorable aspects of the history of the Federal Fisheries Service. On the other hand, the pioneering scientific and technical achievements and frequent success of the government's fish culture programs earned international acclaim. This recognition was highly appreciated in Washington, D.C., and contributed more than any other area of fisheries activity toward making the Fish Commission and its successors among the most popular government agencies.

Fishery Statistics

The third major category of Fisheries Service activity, compilation and use of fishery statistics coupled with the study and assessment of fishery methods, originated within the Fish Commission in logical response to the demands of the basic inquiry. Valid statistics were quickly found to be indispensable in measuring the decline of the fisheries. Likewise, they were vital for the measurement of the effects of

new propagation, acclimatization, and regulatory programs.

Given the heated interstate dispute over use (or misuse) of nets and fish pounds, a careful evaluation of fishery methods was also mandatory in order for the Fish Commission to make realistic suggestions to the states on the subject of fishery regulation. A significant catalyst for the early formalization of statistical and methodological study came through the precedent for Federal interest in fisheries, the protection of American fishing rights in international waters.

The same year that the Fish Commission was born (1871), considerable progress was made in settling the marathon Anglo-American dispute over fishing rights off the coasts of New England, the Maritime Provinces of Canada, and Newfoundland.⁶ The Treaty of Washington provided for a court to meet from time to time in order to adjudicate controversies arising under the terms of the treaty. Awards by the court were to be in the form of money payments, the amounts of which would be decided after hearing evidence from both sides as to the value of the fishery products realized during the period under discussion. The first meeting of the court, known as the Halifax Commission, was called for the summer of 1877.

The strength of the United States' case clearly would depend on the quality of her statistical presentation in the face of a thoroughly prepared opponent. The Fish Commission was called upon to provide expert witnesses who would be well-armed with the facts and figures of the New England fisheries. Baird and his staff hurriedly but carefully compiled figures as to the character and amount of the catch, the number of men and vessels employed, and the capital investment and proceeds of the American fisheries operating on the treaty coast. The statistical format worked out for the Halifax Commission became the

standard for subsequent reports of the Fisheries Service, and during the ensuing years the State Department cooperated with and depended upon the Fish Commission and its successors.

Through Baird's vision and effort in combating the decline of the New England fisheries, and the unstable circumstances of the international relations, the three dominant and continuing themes of the Federal Fisheries Service were thus established in the first decade of its existence. Not until 1884, however, was a rough divisional structure adopted by the Fish Commission.

Professor Baird, even with his weather eye on Smithsonian responsibilities, was the benevolent master of all the operations of the Commission, which he ran from his residence in Washington when he was not involved in a "summer campaign." In 1882, with Fish Commission expenditures running \$250,000/year, Baird did secure approval for the creation of the salaried post of Assistant Commissioner, an understandable request from a man who was simultaneously chief executive officer of the Smithsonian Institution and the National Museum.

It was later said of Baird that he was preeminently an able scientist who was more excited by a new fossil than by the practical responsibilities of his position (U.S. Senate, 1890). This appraisal is supported by his free-handed appointment of curators from among Federal employees of scientific mind who, regardless of their primary duties, were in a position to augment the National Museum's specimen collection. His solid record of practical achievements, however, leaves no doubt that the able scientist was also an effective leader, a sound organizer, and an astute politician.

Formal USFC Organization

After Baird's death in 1887, the Commission adopted the more formal and elaborate organization usually associated with a Federal agency (U.S. Senate, 1890-91). The plan was drawn by Baird's pupil, collaborator, and successor as Director of the National Museum, George Brown Goode, who

⁶The Anglo-American North Atlantic fisheries dispute began in 1812 when the British abrogated the fishing rights clauses of the Treaty of Paris (1873) and lasted until successfully arbitrated at The Hague in 1910. For a full treatment of this dispute see Dunning (1914) and Innis (1940).

acted as Fish Commissioner until Marshall MacDonald was appointed to the latter post by President Cleveland in 1888. MacDonald had been in charge of fish propagation under Baird.

Under Goode's system the work of the Fish Commission was divided into the divisions of Administration, Scientific Inquiry, Statistical Inquiry, and Fish Culture. While control of the general policy of the Commission was still in the Commissioner's hands, assistants were placed in charge of the three operational divisions, and the duties of each were carefully delineated according to the purposes and functions already well established under Baird. The Division of Administration was responsible for accounts, property and records, and publications, and a clerk or agent was assigned to each subdivision.

This structure remained virtually unchanged until 1940, though it was supplemented by the Alaska Division in 1911 and the Division of Law Enforcement in 1930. The Division of Statistical Inquiry alone was subject to modification. Renamed the Division of Fisheries by MacDonald, its emphasis on fishery methods steadily expanded. The work of this division ultimately included technological service and marketing aids for the processing and sale of fishery products.

The essential soundness of Goode's system is best attested to by its ability to survive leadership by purely political appointees, a Senate inquiry, and assimilation into the Department of Commerce.

Commissioner MacDonald requested a Senate inquiry in 1890 to counter published complaints of inefficiency and dishonesty. The charges were mainly rooted in a Republican effort to replace a Democratic office holder and were judged groundless (Dall, 1915). (Baird had been under similar pressure in 1885 when Democratic office seekers returned to Washington, D.C., for the first time since the Civil War.) An examination of the testimony shows that some of the witnesses were angry less for political reasons than for the fact that MacDonald's scientific qualifications and personality as a leader compared

unfavorably with Baird's (U.S. Senate, 1890, 1890-91).

Political Appointees

The first of two clearly political appointees for the office of Fish Commissioner was George M. Bowers, who served from 1898 to 1913. He was appointed by President William McKinley pursuant to an agreement made by Marcus A. Hanna, chairman of the Republican National Committee, giving McKinley the support of the West Virginia delegation in the Republican National Convention of 1896. Calvin Coolidge is said to have remarked in later years: "That was an awful price to pay for West Virginia." Substantial progress was made in all areas of the Commission's work nonetheless, "chiefly because he had the good sense to rely largely upon his staff of permanent civil servants in all technical matters" (Connery, 1935).

It was during Bowers' tenure as Commissioner that the U.S. Fish Commission lost its status as an independent institution of the government and became known as the Bureau of Fisheries within the Department of Commerce and Labor. Previous efforts to bring the Fish Commission under the surveillance of a cabinet officer had been stoutly resisted by Baird and Goode on the dual grounds that political pressures would prevail and that "departmental subordination always dampens the enthusiasm and stifles the energy of scientific workers." Goode considered especially unfortunate a "... subordination to a division of the Government whose interests, so far as science is involved, are naturally and necessarily in lines quite at variance with the biological investigation for which the Fish Commission was organized" (Goode, 1884).

Once the transfer was made, however, the Bureau of Fisheries received excellent support and a minimum of interference from the successive Secretaries of Commerce, and it reaped particular benefit from its new intra departmental relationships with the Census Office and the Bureau of Statistics, agencies which previously belonged to the Department of the Interior and the Department of

the Treasury, respectively. The transfer of the Coast and Geodetic Survey from the Treasury to the Commerce Department was likewise fortunate. The relative independence of the Bureau of Fisheries was signified by the fact that the office and title of the Commissioner of Fish and Fisheries were specifically retained in the enabling legislation (U.S. Congress, 1903).

The second political appointment for Fish Commissioner was not made until 1933 when President Roosevelt named Frank T. Bell to the post. Bell had been secretary to Sen. Clarence C. Dill (D-Wash.) and remained in his new position until the Bureau was transferred to the Department of the Interior in 1939.

In the interim between Bowers and Bell the dominant tradition of recruiting leaders from among the employees of the Fisheries Service was continued in the persons of Hugh M. Smith (1913-22) and Henry O'Malley (1922-33). Smith had joined the Fisheries Service at age 21 and had worked his way up through positions of increasing responsibility. O'Malley had been in charge of fish culture operations from 1916 to 1918 and subsequently headed the Bureau's Alaska Division, the showcase of practical application of the Service's research findings.

An Alaska Division

The Alaska Division was the youngest of the Service's operational programs and was not given divisional status until 1911, although Commission efforts were drawn to Alaska waters as early as 1889 when the first of a series of investigations of the Alaska salmon fisheries was authorized (U.S. Congress, 1889).

Implementation of the Commission's recommendations for the vast area proved to be difficult in the face of reluctant, often hostile, attitudes of the American, Canadian, and Japanese fishermen who were accustomed to the virtually unrestricted taking of Pacific salmon, *Oncorhynchus* spp., and seals. Direct supervision of the Alaska salmon fisheries was transferred to the new Bureau of Fisheries in 1905, and that of the fur seal, *Callorhinus ursinus*, fisheries on the Pribilof Islands in 1908.

The unique nature of the government's efforts to regulate the Alaska fisheries lies in the fact that Alaska, as a new territory, was subject to Federal fish and game laws. The need to enforce international fishing rights was also present. Thus, the activities of the Bureau of Fisheries' Alaska Division combined all phases of Federal fisheries concern. The advent of the police function would surely have surprised the otherwise far-seeing Professor Baird.

Before moving to a more detailed description and appraisal of the four major operating divisions of the Fisheries Service, two other areas of activity need brief discussion: The Service's contributions in treaty negotiations and participation in national and international exhibitions and conferences.

Treaty Negotiations and National and International Exhibitions

The participation of the Fish Commission in the Halifax Commission of 1877 formed the precedent of cooperation with the State Department in many subsequent international fisheries negotiations. Foremost among these were: the Bering Sea Case, argued before the Tribunal of Arbitration at Paris in 1892 and culminating in the Convention of 1911; the long-standing Anglo-American dispute, finally resolved before the International Court of Arbitration at The Hague in 1910; the U.S.-Canadian Northern Pacific Halibut Treaty of 1923; the Fraser River Sockeye Salmon Treaty with Canada, finally ratified in 1937; and a series of joint regulation efforts with Canada regarding the Great Lakes fisheries. The Fisheries Service also provided personnel for the joint control commissions which typically resulted from these international agreements.

In the exhibition field, the Federal Fisheries Service contributed displays to no less than 14 expositions in the United States and 5 in foreign countries between 1876 and 1907. Table 1 shows a partial list of exhibitions showing the scope of this Fisheries Service activity. Many of the displays were of prize-winning quality, particularly during the period when the Fish Commission's relationship with

the Smithsonian Institution was so close. Elaborate aquarium "grottos" displaying live fish and the hatching of fish eggs before the public's gaze were among the most popular presentations. Despite the fact that excessive time spent on exhibition work drew occasional complaints from Commission personnel, the public relations value of these efforts to the Fisheries Service and to the country was noteworthy. The international image of the United States as an enlightened leader in scientific marine studies and fish culture was earned in the area of the nation's self-conscious emergence as a world power.

Biological Investigations and Fishery Surveys

Congress' joint resolution of 1871 required the new Fish Commissioner "to prosecute investigations and inquiries" to determine the reasons and suggest the cure for the alleged decreases in food fishes of the coast and lakes of the United States (U.S. Congress, 1871). However, this primary mission was easier to describe than accomplish.

Confronted with a paucity of prerequisite biological and statistical data, the Service undertook with unremitting energy "the work of the investigation into the general and economical history of the fishes and other marine animals" (U.S. Commission of Fish and Fisheries, 1874-75). The "general history," interpreted as the collation of basic biological and oceanographic studies, required the services of trained naturalists, and the manifold contributions of such professionals became the identifying characteristic of the Division of Scientific Inquiry. The "economical" history of the fisheries demanded statistical research coupled with practical analysis of fishing methods, neither of which required formal scientific education. Studies of this nature became the responsibility of the Division of Fisheries.

Prior to the adoption of Goode's divisional structure in 1887, there was no formal distinction between the two groups. Both evolved from Professor Baird's need for competent assistance to supervise inquiry programs and thus re-

Table 1.—List of expositions and fairs containing Federal Fisheries Service exhibits.¹

Date	Title and location
1876	Centennial Exhibition at Philadelphia, Pennsylvania
1880	Berlin Fishery Exhibition at Berlin, Germany
1883	London International Fisheries Exhibition at London, England
1884	International Cotton Exhibition at New Orleans, Louisiana
1886	Louisville Exposition at Louisville, Kentucky Nebraska State Fair at Lincoln, Nebraska Industrial Exposition at Wilmington, Delaware
1888	Centennial Exposition of the Ohio Valley and Central States at Cincinnati, Ohio
1893	Columbian Historical Exposition at Madrid, Spain World's Columbian Exposition at Chicago, Illinois
1895	Cotton States and International Exposition at Atlanta, Georgia
1897	Tennessee Centennial Exposition at Nashville, Tennessee
1898	Trans-Mississippi and International Exposition at Omaha, Nebraska
1901	Pan-American Exposition at Buffalo, New York
1902	South Carolina Interstate and West Indian Exposition at Charleston, South Carolina
1903	Louisiana Purchase Exposition at St. Louis, Missouri
1907	Jamestown Ter-Centennial Exposition near Norfolk, Virginia
1909	Alaska-Yukon-Pacific Exposition at Seattle, Washington Centennial of Ecuadorian Independence at Quito, Ecuador
1930	International Fur Trade Exhibition at Leipzig, Germany
1931	International Colonial Exhibition at Paris, France

¹This is a partial listing of the fairs and expositions to which the Fisheries Service contributed displays. Sources are the annual reports of the Fisheries Service under their various titles from 1872 through 1941 (see Literature Cited).

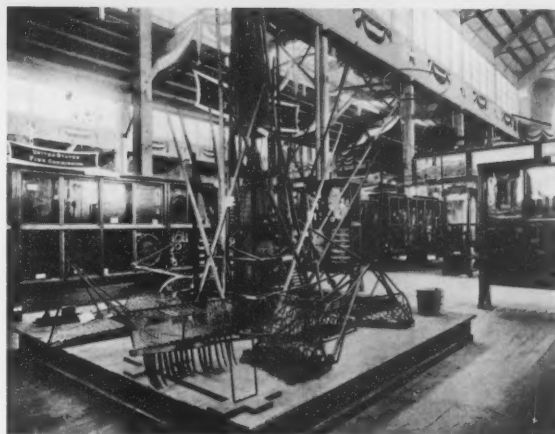
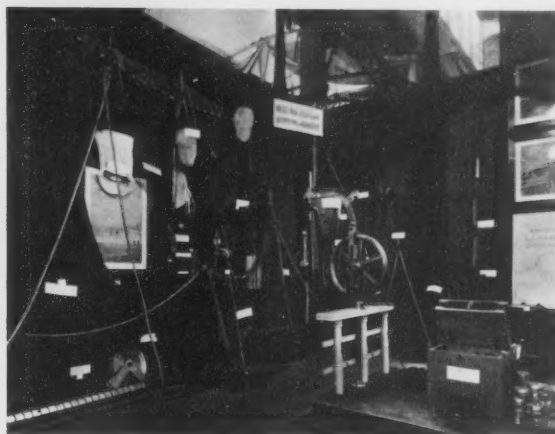
lieve the Commissioner of the growing workload attendant to the combination of his Fish Commission and Smithsonian responsibilities. Goode was placed in charge of Inquiry in 1876, and in 1884 a general Division of Inquiry became part of the still informal organization of the Commission.⁷

The Division of Scientific Inquiry and its impromptu predecessors were deeply involved from the outset with fundamental biological investigations. For Professor Baird and his scientific associates, both in and out of the Federal government, such investigations were an extension of older interest in pioneering explorations into the character of aquatic life.

⁷The year 1876 was a busy year for Baird. Hard at work on displays for the Centennial Exposition at Philadelphia, he had been promised funds for a museum building if the proceeds from the Exposition were sufficient to repay government loans made to the Exposition corporation (Dall, 1915).



U.S. Fish Commission exhibit at the 1893 World's Columbian Exposition in Chicago, Ill. (U.S. Commission of Fish and Fisheries, 1895-96).



The excitement of scientific discovery in the post Civil War years was pervasive and intense. Such men as Charles Darwin and his disciple Thomas Huxley, and Louis Agassiz and his son Alexander, appeared to be a race of giants. Baird, a friend of the Agassizes and motivated by the spirit of the times, seemingly without compunction employed Fish Commission resources for uses not sanctioned by the letter of the joint resolution in the cause of pure biological research.

Ecological Research

Yet careful to justify all Commission activities to Congress, Baird wrote in his first report on the originally authorized inquiry that an incidental object "... was to work out the problems connected with the physical character of the seas adjacent to the fishing localities, and the natural history of the inhabitants of the water, whether vertebrate or invertebrate, and the associated vegetable life; as also to make copious and exhaustive collections of specimens, for the purpose of enriching the National Museum at Washington and furnishing duplicates for distribution in series to such suitable collegiate and other cabinets as might be recommended for the purpose.

"This research into the general history of the waters was considered legitimate, as, without a thorough knowledge of the subject, it would be impossible to determine, with precision, the causes affecting the abundance of animal life in the sea and the methods for regulating it; and the record of these facts, accompanied by proper illustrative figures, it was believed would be a very acceptable contribution to the cause of popular education, and supply a want which has long been felt in this country" (U.S. Commissioner of Fish and Fisheries, 1871-72).

Given Baird's enthusiasm for basic research, a tolerant Congress, and, above all, a serious lack of knowledge in the field of study, it is not surprising that the biological investigations of the first 30 years emphasized the collection and classification of specimens, oceanographic studies, and the compilation of the life histories of marine and freshwater vertebrates and invertebrates.



Fish promotional poster, courtesy of the National Archives.

Disease and Food Processing Research

As the gap in basic knowledge was narrowed, the scientific work of the Service assumed a more practical character. The problems attendant upon the efficient and successful propagation of fishes and other aquatic animals took more of the time of the scientific personnel than before. New emphasis was given to the study of the diseases and other enemies of important species.

World War I brought to national consciousness the need for an adequate food supply, and the Division of Scientific Inquiry responded with increased attention to studies in the processing, preserving, and packaging of aquatic foods. After the war, the sharp inflation and the demand for scientists in better-paying private jobs seriously crippled the Division; half of its scientific personnel had resigned by mid 1921 (U.S. Department of Commerce, 1921).

The investigations now reflected a growing awareness of the need for interdisciplinary ecological studies in the cause of conservation. Water pollution began to receive attention as a major problem, and the accelerating construction of dams for watershed control, irrigation, and power required the advice of scientists from the Fisheries Service.

Applied Science Emphasis

In the report of the Division for 1930 the new emphasis on applied rather than pure science was apparent. The Division's stated purposes were "to promote the conservation activities of the states," "to foster and encourage aquaculture," and "to aid industry in the utilization of aquatic resources." The most important function of the Division was considered to be the acquisition of "fundamental knowledge of the fisheries, marine, commercial, freshwater, or sports, to serve as the basis for so regulating the take that an adequate breeding stock will be maintained, assuring continued productivity of supply" (U.S. Department of Commerce, 1930).

Over the entire period from 1871 to 1941, the Division of Scientific Inquiry was constantly involved, along with the Division of Fisheries, in surveys ranging in scope from entire seas and river systems to small inland lakes and streams. The most important areas, such as the Alaska fisheries, were under repeated investigation.

Considering the volume and variety of their assignments, along with the fact that the priority arrangement of their tasks was generally beyond their control, the scientists of the Fisheries Service were often frustrated by shortages of men and means.

In response to the varying demands of these studies, the Division quickly established a pattern of operation that permitted the most flexible application of available knowledge, men, and resources. In most cases the pattern contained the three mandatory components of trained specialists, shore establishments where data could be collated and reports prepared, and suitable vessels.

One important facet of Baird's genius was his ability to enlist, often gratis, the time and talents of outstanding biologists whose main interests and sources of livelihood lay outside the work of the Commission. For at no time during the period under review was it plausible or desirable for the Federal government to monopolize the field of marine biological research. Cooperative endeavor was epitomized in the concept and utilization of the research centers at Woods Hole, Mass., and Beaufort, N.C.

Woods Hole Station

The biological station at Woods Hole was the first permanent research installation of the Fisheries Service. The site was selected in 1882 when, after 10 years of nomadic summer operations along the New England coast, the Commission's need for a research base was reinforced by its requirements for a marine fish hatching station and docking facilities for its new research vessels.

From the beginning, the "summer campaigns" of the Commission had been characterized by a gathering of distinguished biologists who shared the temporary facilities, paid their own personal expenses, and contributed to the work of the inquiry. Freedom to pursue their own research projects was not questioned (U.S. Commission of Fish and Fisheries, 1882-83).

When Baird selected Woods Hole as a permanent site, the cooperative spirit of the scientific community evidenced itself in the purchase of the land in advance by private subscription. The land was to be held by trustees subject to transfer of title of all or part to the government upon demand from the



Original Woods Hole Laboratory on buoy wharf, courtesy of the National Archives.

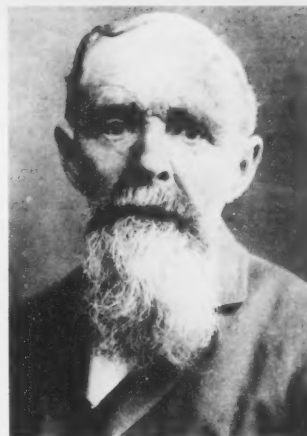


Site of the Fisheries Service in Woods Hole before buildings were constructed, courtesy of the National Archives.



The Fisheries Service buildings in Woods Hole, in 1890, courtesy of the National Archives.

Vinal N. Edwards (1840-1919), the first permanent Federal Fisheries Service employee, was hired in 1871 and worked at Woods Hole as an all-around technician, a position he held until his death in 1919. Though not formally trained as a scientist, he was considered an "intuitive" naturalist with an encyclopedic knowledge of the ocean processes and marine life in and around Woods Hole.



Fish Commission or the Treasury Department. Johns Hopkins and Princeton Universities, Williams College, and Alexander Agassiz were among the eight subscribers who together paid \$7,250 for the property after being reassured by Congress that the government would construct a sheltering pier. The pier and a suitable building were completed in fiscal year 1885 at a total cost to the government of \$77,000 (U.S. Commission of Fish and Fisheries, 1883-84).

The station has been in continuous operation since that time, though under Navy control during World War I, and it has never ceased to be a center for cooperative oceanographic and biological research. Private studies were inaugurated in the area in 1930 with the establishment of the Woods Hole Oceanographic Institution.

Beaufort Laboratory

The biological station at Beaufort, N.C., completed in 1902 at an expense of \$400 to the land donors and \$12,500 to the government, provided a research center for studies in southeastern U.S. waters. Like Woods Hole, Beaufort has long been used as an informal base for marine exploration. The precedent of mutual cooperation with non Fish Commission scientists was maintained. In the summer of 1900, for example, with work still being conducted out of temporary quarters, the director of research was Professor Henry V. Wilson of the University of North Carolina (U.S. Congress, 1901-02a, 1901-02b, and 1902-03).

Iowa and Florida Stations

Two other biological stations were subsequently established by the Fisheries Service, one at Fairport, Iowa, in 1911, and the other at Key West, Fla., in 1917. The spirit of cooperation with non Federal scientists acting in a private capacity was not so marked in the operation of these two, perhaps because their locations were inconvenient to educational centers and because the nature of the work carried on at the stations was no longer sufficiently novel to elicit the enthusiasm of an earlier era.

The Fairport station, built at an initial cost of over \$100,000, served



Woods Hole Marine Laboratory and hatchery (U.S. Department of Commerce and Labor, 1908).



Residence of the Woods Hole Marine Station, formerly the summer headquarters of the Fisheries Service (U.S. Department of Commerce and Labor, 1908).

as a base of operations for most of the Fisheries Service's scientific work in the Mississippi basin. It concentrated on freshwater fish culture experiments and particularly on the artificial propagation

of the freshwater mussel, belonging to the order Unionoida, the major source of "mother of pearl" for the button industry (Coker, 1921; U.S. Congress, 1908-09, 1909-10b, and 1910-11). The



Biological Station at Beaufort, N.C.
(U.S. Department of Commerce and Labor, 1908).



Henry Van Peters Wilson, Director
of the Biological Laboratory,
1899-1901.



Fairport National Fish Hatchery in Muscatine, Iowa (ca. 1920), courtesy of the Iowa Department of Natural Resources.

Key West station, envisaged as a center for biological study and experimentation for the Gulf coast, was severely affected by personnel shortages and high construction costs after World War I and never approached its potential. Although some new species were collected and studied there, the property was returned to its previous owners in

1929 (U.S. Commissioner of Fisheries, 1920; U.S. Department of Commerce, 1929).

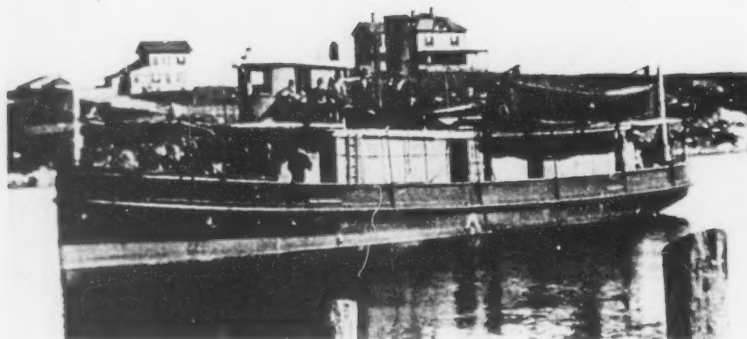
Along with trained specialists and shore facilities, the vessels adapted for marine research constituted the third component of the investigational pattern of the Division of Scientific Inquiry. Detailed reports of specific voyages of

exploration comprised a very important segment of the Division's contribution to marine hydrographic and biological knowledge.

Research Vessels

Until 1880 the Fish Commission received no specific vessel appropriations, and Baird relied upon Congress' origi-

The Albatross



U.S. Navy steam tug *Bluelight* courtesy of the NOAA Photo Library.

nal injunction which required the executive departments of the government to furnish the new Fish Commission "all necessary and practicable aid" (U.S. Congress, 1871). The Navy Department provided a 100-ton steam tug (the *Bluelight*) in 1873 and a 306-ton vessel in 1877 (the *Speedwell*), both of which were modified to handle the trawling apparatus required for the collection of offshore specimens. The Treasury Department's Revenue Service and Lighthouse Board loaned smaller boats when available for the inshore work of the New England inquiry.⁸

Although the scientific operations were supervised by the Fish Commission, the commanding officers and most crew members were provided and paid by the Navy. This practice continued with the vessels that were subsequently constructed or purchased for the Fisheries Service.

The completion of the fisheries steamer *Fish Hawk* in 1880 marked the beginning of the Service's direct responsibility for the maintenance and, to a limited extent, design of its

own vessels. Although most of those utilized by the Service from 1880 to 1941 were purchased from previous owners and served in less glamorous duties, the *Fish Hawk*, the *Grampus*, and, most notably, the *Albatross* were designed and built as research vessels and became symbols of the Fisheries Service's scientific explorations. Their design features were frequently as innovative as their work.

The *Fish Hawk*, a twin-screw steamer of 146 feet at the load water-line, cost about \$90,000 by the time she was fully equipped in 1882. A floating fish hatchery and laboratory, she was too small for sustained off-shore cruising and spent over 40 years in the coastal waters, bays, and rivers of the Atlantic on research and fish propagation assignments (U.S. Congress, 1879-80a, b; Tanner, 1881-82).

The *Grampus*, constructed in 1886 at a cost of \$14,000, was an 81-foot wooden schooner whose service was also confined to the Atlantic. The most interesting features of her construction stemmed from her purpose: She was carefully designed to correct unseaworthy characteristics of the traditional New England fishing smacks. As such, she was intended to be a model for future private construction. A central fish-well adapted her to at-sea live specimen collection and fish propagation duties (U.S. Commission of Fish and Fisheries, 1884-85; U.S. Congress, 1884-85; Collins, 1888-89).

The "darling" of the Fisheries Service was the *Albatross*, completed in 1882 at a cost of \$190,000. A 1,074 ton, twin-screw steamer, measuring 200 feet at the load water-line, she was designed and built for deep-water surveys. After first serving in the Atlantic, she left Cape Horn to starboard in 1888 and did not return to east coast research until 1920. Her Pacific explorations, extending north to the Bering Sea and west to Japan and the Philippines, were interrupted only by military service. The scientific work of this vessel, under such distinguished directors as Alexander Agassiz, comprised some of the most outstanding accomplishments of the Fisheries Service, and subsequent research vessels were honored by her name, including the *Albatross III* which was commissioned in 1940 (U.S. Congress, 1880-81, 1881-82b; Tanner, 1881-82; MacDonald, 1921; U.S. Department of the Interior, 1955).

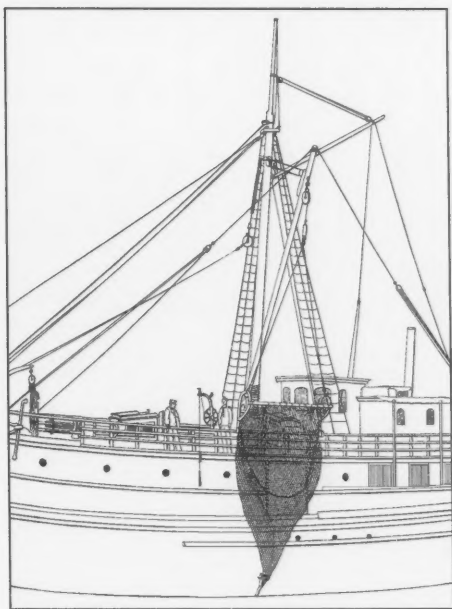
From 1871 to 1941, the flexible combination of specialists, shore facilities, and suitable vessels enabled the Division of Scientific Inquiry to accomplish hundreds of surveys, investigations, and experiments. A complete listing would be too lengthy for inclusion here but the following summary will suggest the scope of the work accomplished. A full listing is given in MacDonald (1921) and U.S. Department of the Interior (1955).

The reports of the Division fall mainly into two groups, those which embraced geographic areas of fisheries and those which focused on observation of, or experimentation with, individual species. A third and less numerous category of peripheral studies includes such subjects as nutritional values, the processing and preservation of fisheries products and byproducts, and pollution analysis and control.

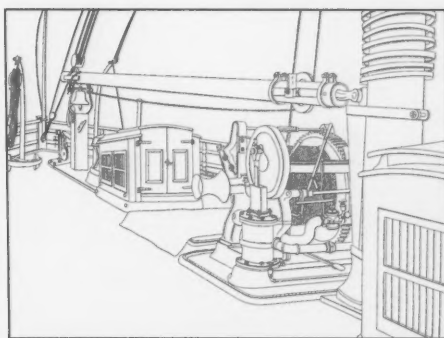
Fishery Surveys

The geographical surveys covered all the coastal waters of the continental United States with repeated emphasis upon the important fisheries of New England and the Pacific Coast. Also thoroughly covered were Long Island

⁸The Lighthouse Board also cooperated by taking temperature readings at its coastal installations. For a resume of the early years see: George Brown Goode, "First Decade of the United States Fish Commission," Appendix A, II. In Report of the Commissioner for 1880, Senate Misc. Doc. No. 29, 46th Congr., 3rd sess., 1880-1881, p. 53-62 (in PD 1947). [Also in Mar. Fish. Rev. 50(4).] For credits to other government bureaus see same Senate Doc., p. XIX.



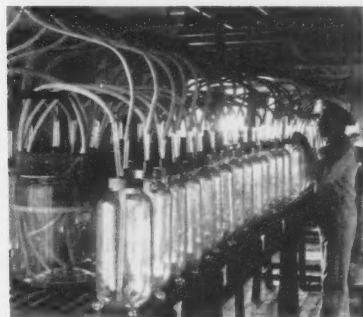
The beam trawl ready for lowering (U.S. Commission of Fish and Fisheries, 1881-82).



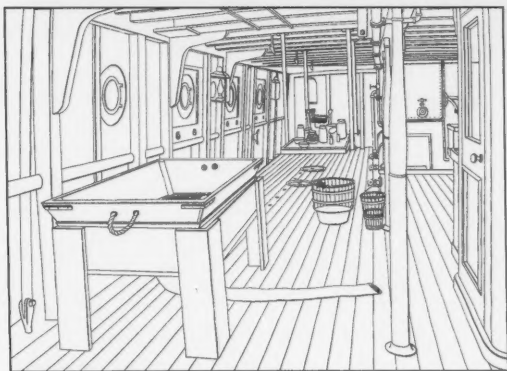
Hoisting and reeling engine, from aft looking forward (U.S. Commission of Fish and Fisheries, 1881-82).



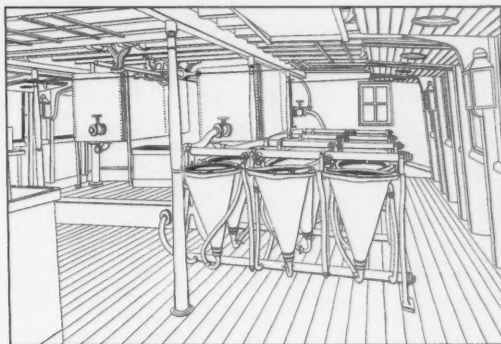
Main deck, showing arrangement of McDonald jars for hatching shad (U.S. Department of Commerce and Labor, 1908).



Fisheries Service steamer *Fish Hawk*, engaged in hydrographic and biological surveys on the New England coast, was often employed as a shad hatchery on east-coast rivers (U.S. Department of Commerce and Labor, 1908).



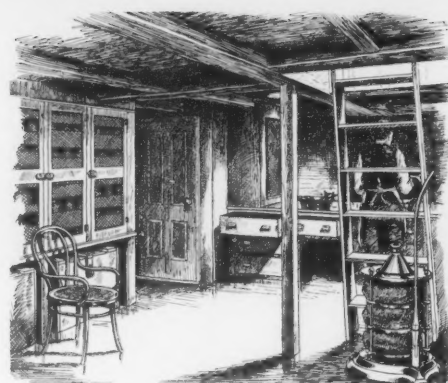
Main deck, starboard side, table sieve, swinging table, and collecting apparatus (U.S. Commission of Fish and Fisheries, 1881-82).



Port side of the main deck, showing portion of the hatching machinery (U.S. Commission of Fish and Fisheries, 1881-82).



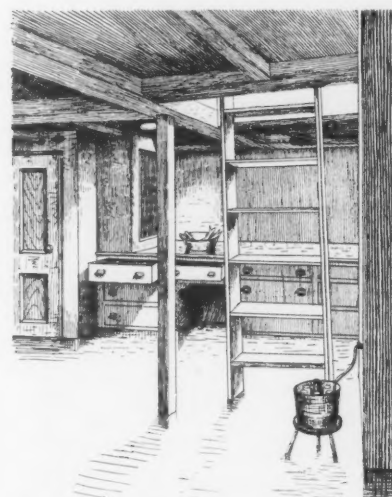
The laboratory, looking forward
(U.S. Commission of Fish and Fisheries, 1888-89).



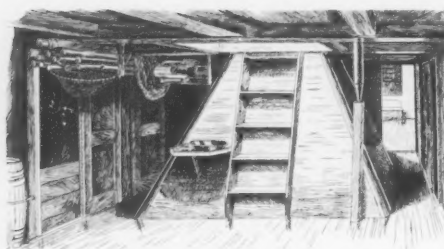
The laboratory, looking toward after-port side
(U.S. Commission of Fish and Fisheries, 1888-89).



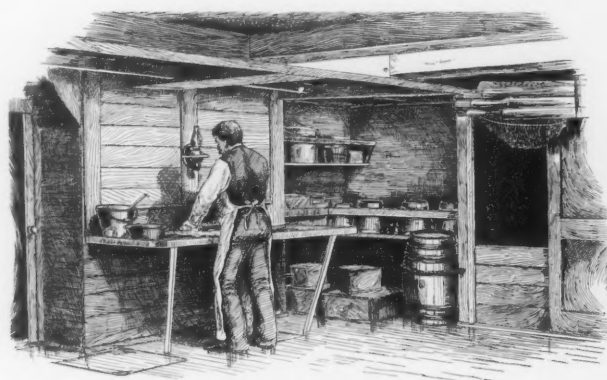
Fisheries Service schooner *Grampus*
(U.S. Department of Commerce and Labor, 1908).



View of the laboratory, with McDonald's
hatching-bucket in operation (U.S. Commission of Fish and Fisheries, 1888-89).



The forehold, looking aft (U.S. Commission of Fish and Fisheries, 1888-89).



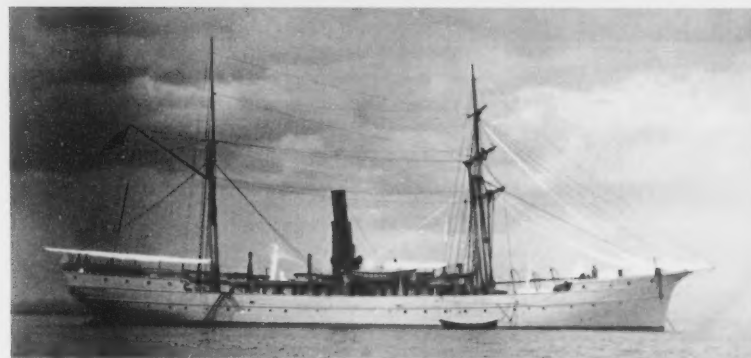
The forehold, looking starboard (U.S. Commission of Fish and Fisheries, 1888-89).



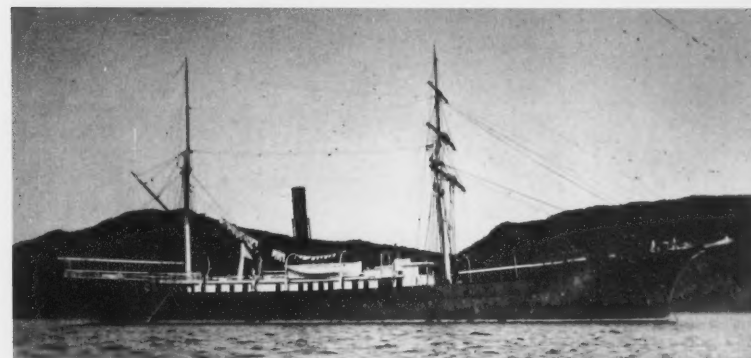
The *Albatross* in southeast Alaska, courtesy of the National Archives.



Salmon trap at Pt. Roberts, Wash., inspected by staff of the *Albatross* in 1895, courtesy of the National Archives.



The *Albatross* in Panama (ca. 1890), courtesy of the National Archives.

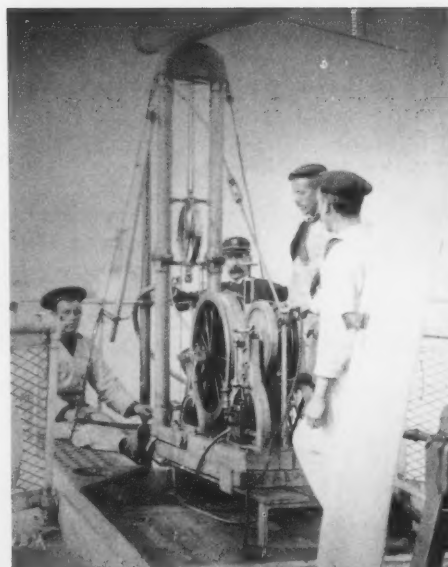


Alexander Agassiz
courtesy of
Harvard University Archives.

The *Albatross* at anchor, Port Otway, Western Patagonia, in 1888, courtesy of the National Archives.



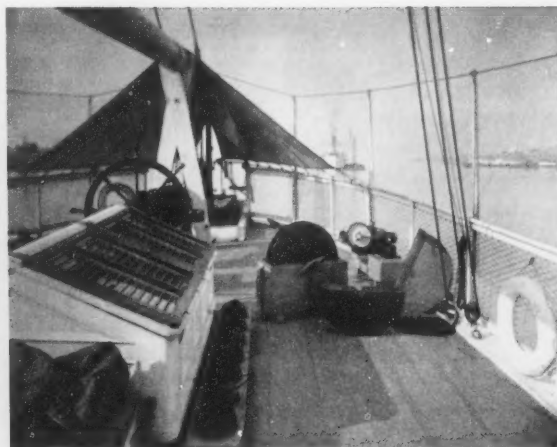
Stern of the *Albatross* showing a Sigsbee Sounding Machine (ca. 1890's), courtesy of the U.S. Army Military History Institute.



Stations at the Sigsbee Sounding Machine onboard the *Albatross* courtesy of the National Archives.



The *Albatross* at anchor in Borja Bay, southern tip of South America, in 1888, courtesy of the National Archives.



Deck of the *Albatross* in 1895 courtesy of the National Archives.

Sound, the Delaware and Chesapeake Bays, the North Carolina Sounds, and the Gulf of Mexico. The Fisheries Service was particularly interested in areas where oyster, lobster, shrimp, and crab fisheries were of commercial importance. Beyond the continental limits, the valuable Alaska salmon and seal fisheries received the greatest attention. Special studies were made of the Japanese fisheries and those of the Philippine and Hawaiian Islands and the U.S. possessions in the Caribbean Sea.

Interior surveys were conducted on most of the river systems of the country. Though work in the Mississippi Basin was prominent, particular attention was given to those rivers in which sea-run fish (i.e. salmonids and shad, *Alosa sapidissima*) were of commercial importance. The Great Lakes were under almost constant scrutiny from 1871 onward. Surveys of smaller interior lakes and streams were undertaken in great numbers for the purpose of improving the potential of commercial and sport fishing, often at the request of Members of Congress. The states gradually took over most work of this nature, while the Federal Service gave greater attention to government-owned areas, particularly National Parks.

As far as individual biological investigations were concerned, the principal thrust of the earlier inquiries was to master the life histories of all of the important commercial and game fish. This massive project led to detailed research into the anatomy, embryology, and physiology of fish and into their foods, enemies, and parasites. Environmental information such as the temperature, salinity, and density of the water were also scrutinized, as were, in short, all discernible factors that affected the lives of fishes.

The scope of the studies embraced a variety of aquatic animals other than fishes, some because of their relationships with commercial fish species, others because they had substantial commercial value in their own right. Prominent among the latter were mammals such as whales, seals, and sea otters; mollusks, particularly oysters; crustaceans such as crabs, lobsters,

shrimps, and crayfish; porifera, especially the marketable sponges of the Gulf of Mexico; and reptiles and amphibians such as edible terrapins and frogs.

Practical Research

As the biological data essential for the life histories became better known, more practical experimentation in the field of artificial propagation became possible. The Division undertook work that was beyond the abilities of the regular station personnel of the Division of Fish Culture. Experiments were conducted with most species of commercial and game fish, and in the nonfinfish group with oysters, lobsters, freshwater mussels, sponges, and diamondback terrapins. Increasing emphasis on the study of the diseases of fish accompanied fish culture experimentation, and, in some cases, had useful application to human medical studies.

Considering the primary role of geographical surveys and biological investigations in providing the indispensable scientific data upon which the Fisheries Service's recommendations were made, the expenditure of public money for this purpose was relatively meager when compared to that allocated to the Division of Fish Culture and the Alaska Division. Only the Division of Fisheries received a smaller percentage of the budget. Tables 2-7 list Divisional budget breakdowns.

Excepting fiscal year 1872, when the entire allocation of the Fish Commission was designated for the inquiry into the decrease of food fishes, annual appropriations made specifically for the inquiry and attendant biological investigations dropped from 15% of the Fisheries Service's total budget in the first decade, to 5% in 1914, averaging about 7% over that period. Dollar amounts, however, rose quite steadily from about \$15,000 to \$172,000 an-

nually in the same years.⁹ From 1915 through 1925, appropriations fell in percentage and amount to 2.5% and \$75,000, respectively, while from 1926 through 1941 both figures rose to new highs of 16% and \$788,000. At the end of the period they were influenced by anti-Depression spending. Over the entire 70-year span, the Federal government earmarked about \$11.4 million for scientific inquiry at an average of \$163,000 and 8% of the Fisheries Service budget per year.

The above figures are seriously understated to the extent that costs attendant to the investigations were accounted for under different headings, and to the extent that no valuation is imputed for the contributions made by cooperating private investigators. Fisheries Service vessel costs, listed separately from 1880 to 1941, amounted to over \$21 million, a yearly average of \$388,000 representing 14% of the total budget. They did not include crew salaries paid by the U.S. Navy. Table 7 lists vessel expenditures.

Administration Division salaries (including the Commissioner's after 1887), permanent biological station personnel salaries, and those of a flexible manpower pool entitled "Employees at Large" were also carried separately. In the typical year of 1914, for example, administrative salaries were \$159,500, biological station personnel salaries were \$78,300, and "at large" salaries stood at \$43,200. Division salaries and expenses by themselves were budgeted at \$172,000 (U.S. Congress, 1913-14).

USFC Publishing

The accomplishments of the Division of Scientific Inquiry cannot be justly evaluated in terms of dollars alone. A full assessment must also take into account the quality of the Division's analysis and presentation of the collected data, the extent of the contributions to the sum of human knowledge, and the impact of the findings on the nation's too often belated efforts to conserve her natural resources.

The quality of analysis and presentation was of impressive excellence. From

⁹Dollar amounts in this and the following paragraph have been converted to their equivalent totals in 1958 dollars. Thus adjusted to allow for the fluctuating value of the dollar over the 70-year period, dollar comparisons between one year and another are as valid as the limitations of the indexes used permit them to be. See notes to Table 2 for citation of the indexes used.

the beginning, the Annual Reports of the Fish Commission became the repository for the latest and most authoritative articles on aquatic biology, fishery methods, and oceanography. Many contributions were authored by outstanding specialists of the day.

From 1881, the annual *Bulletin* was published to accommodate the growing volume of such material (U.S. Commission of Fish and Fisheries, 1881-82). An outstanding library on

fishery-related subjects grew steadily at the Commission's Washington headquarters, and the reports received worldwide circulation.

A prominent example of the thorough work of the scientists was the immense five-section (in seven volumes) publication titled "The Fisheries and Fishery Industries of the United States," published from 1884 through 1887 with the cooperation of the Superintendent of the Tenth Census. Generously supplied

with appropriate plates and charts, its five sections included an extensive natural history of useful aquatic animals, a geographical review of the fisheries industries for 1880 (including much historical material), detailed studies of the fishing grounds of North America, and an examination of the history and methods of the fisheries including the fishermen themselves (U.S. Congress, 1881-82a).

Valuable Contributions

Although much of the printed output of the Division was so highly technical as to be of direct utility only to other specialists, it was work of this nature that made the most valuable contribution, not only by advancing knowledge, but also by stimulating non Federal investigations. The maturing of state fisheries methods and policies was in many cases attributable to the Federal example of decisions based on sound scientific evaluation. Failures to implement Fisheries Service recommendations were rooted in personal quarrels and political or diplomatic difficulties rather than in unsound scientific advice. Where put into effect, as in Alaska, the Service's recommendations almost invariably benefitted the nation's fisheries and the cause of conservation.

The Division of Fisheries, as noted, was created in 1888 and was responsible for the compilation and analysis of the statistics and methods of fisheries. Early work was made difficult by the fragmentary nature of existing data, but a comprehensive effort in cooperation with the Census Bureau enabled the Commission to make "The Fisheries and Fishery Industries of the United States" the first reliable report on the full scope, methods, and value of the nation's fishery resources (U.S. Commission of Fish and Fisheries, 1879-80; U.S. Congress, 1881-82a). Henceforward, statistical efforts were characterized by the updating of regional fishery figures as often as the resources of the Division would permit. Studies of fishing methods were of a wide variety and tailored to the current needs of fishermen, fish processors, fish marketers, and to some extent, consumers.

Table 2.—Total expenditures of the Federal Fisheries Service, fiscal years 1872 through 1941¹ (amounts in thousands of dollars).

Fiscal year	Fiscal year expenditures	1958 dollars ²	Fiscal year	Fiscal year expenditures	1958 dollars ²
1872	8.5	26.0	1909	851.0	2,925.0
1873	30.0	92.0	1910	731.0	2,453.0
1874	38.5	119.0	1911	863.0	2,894.0
1875	23.5	72.0	1912	1,133.0	3,667.0
1876	71.0	217.0	1913	945.0	3,038.0
1877	36.0	110.0	1914	1,047.0	3,335.0
1878	96.0	293.5	1915	1,118.0	3,452.0
1879	51.0	189.0	1916	1,075.0	2,938.0
1880	157.0	581.0	1917	1,145.0	2,538.0
1881	114.0	423.0	1918	1,264.0	2,407.0
1882	301.0	1,115.0	1919	1,183.0	2,199.0
1883	233.0	864.0	1920	1,397.0	2,278.0
1884	249.0	922.0	1921	1,231.0	2,354.0
1885	253.0	937.0	1922	1,247.0	2,524.0
1886	257.0	951.0	1923	1,392.0	2,741.0
1887	259.5	961.0	1924	1,230.0	2,455.0
1888	254.0	942.0	1925	1,500.0	2,935.0
1889	285.5	1,102.0	1926	1,555.0	3,031.0
1890	293.0	1,155.0	1927	1,814.0	3,628.0
1891	253.0	1,412.0	1928	2,124.0	4,213.0
1892	364.0	1,510.0	1929	2,092.0	4,134.0
1893	354.0	1,447.0	1930	2,219.0	4,500.0
1894	386.0	1,680.0	1931	2,632.0	5,875.0
1895	316.0	1,392.0	1932	2,906.0	7,228.0
1896	411.0	1,862.0	1933	1,976.0	5,028.0
1897	390.0	1,755.0	1934	1,810.0 ³	4,290.0
1898	420.0	1,832.0	1935	1,332.0 ³	3,127.0
1899	494.0	2,095.0	1936	1,566.0 ³	3,667.0
1900	475.0	1,923.0	1937	1,591.0 ³	3,575.0
1901	497.0	2,029.0	1938	1,992.0 ³	4,538.0
1902	568.0	2,237.0	1939	2,022.0 ³	4,680.0
1903	496.0	1,931.0	1940	2,259.0	5,147.0
1904	661.0	2,543.0	1941	2,305.0	4,885.0
1905	711.0	2,672.0	Totals	52,738.0	165,642.5
1906	712.0	2,617.0	Average annual expenditure	753.4	2,366.3
1907	694.0	2,452.0			
1908	704.0	2,504.0			

¹Budget data for Tables 2-7 were compiled from applicable appropriations Acts for the fiscal years cited as found in *Statutes at Large*, Vol. 16-55, 41st-77th Congr., 1870-1942. Totals were cross-checked with brief statements of expenditures that sometimes were included with the annual reports of the Fisheries Service. Minor discrepancies often appeared because appropriations were not fully expended in the time period for which they were authorized. In such instances the figures given in the appendices were taken from the appropriations Acts rather than the annual reports.

²Actual dollar figures for the years cited were converted into constant 1958 dollars by the use of implicit price deflators for the Gross National Product, B62 and B63, as found in U.S. Department of Commerce, Bureau of the Census, Long Term Economic Growth: 1860-1965 (Gov. Print. Off., Wash., D.C., 1966), p. 200, 201. The conversion is based on series B63 which is taken from U.S. Department of Commerce, Office of Business Economics, Survey of Current Business, and uses an index in which the base year is 1958 (1958=100) and which runs back through 1929. The B62 series, using 1929 as the base year and running back to the 1870's, was mathematically linked to express its index in terms of the 1958-based series. The original source of the B62 series is John W. Kendrick, National Bureau of Economic Research, Productivity Trends in the United States.

³The figures given for the years 1934 through 1939 do not include approximately \$3 million in actual dollars allocated for the direct benefit of the Fisheries Service through government anti-depression agencies, such as the Public Works Administration (\$1.14 million), the Works Progress Administration (\$813,000), and the Civil Works Administration (\$38,000). Another \$998,000 was allocated under the National Industrial Recovery Act. See U.S. Department of Commerce, Twenty-seventh Annual Report of the Secretary of Commerce: 1939 (Gov. Print. Off., Wash., D.C., 1939), p. 5.

Fishery Statistics

The efficiency of statistical collection depended directly on the development and utilization of reliable sources. Since the ultimate source was the fisherman himself, the Division employed a variety of methods to reach him. Division agents were sent out to make specific canvasses; statistical circulars were sent by mail, and direct correspondence was carried on; local agents and commercial bureaus were consulted when available; a card file on individual boats was maintained; and, as a final resort, newspaper clippings were utilized (U.S. Commission of Fish and Fisheries, 1889-90).

As state cooperation developed, the Division was enabled greatly to quicken its work. Often the Division compiled and printed reports based on data collected by cooperating states. In census years the division worked closely with the Census Bureau, and canvassing was sometimes done under the latter's direction with the assistance of fisheries personnel (U.S. Department of Commerce and Labor, 1909).

The first "Statistical Digest" covering all regions on an annual basis was published in 1942 for the year 1939. Prior to that time, less complete annual reports appeared in various publications of the Fisheries Service, particularly in the Reports of the Commissioner and in Divisional publications. Well organized areas, such as Boston and Gloucester, Mass.; Portland, Maine; and Seattle, Wash., received monthly reports. In the last instance the data were collated at a Division office established in Seattle in 1914. Many special reports were prepared which, because of their limited scope, were never printed for general use (Bureau of Fisheries, 1915; U.S. Department of the Interior, 1939).

Fishery Methods

The Division's work on the methods of the fisheries industries was roughly divided into the three categories: Service to the fishermen, service to the commercial intermediaries who processed and packaged aquatic food and frequently financed the fishermen, and service in the marketing of fishery

Table 3.—Expenditures of the Federal Fisheries Service for the Division of Scientific Inquiry, fiscal years 1872 through 1941¹ (amounts in thousands of dollars).

Fiscal year	Fiscal year expenditures	1958 dollars ²	Percent of total budget	Fiscal year	Fiscal year expenditures	1958 dollars ²	Percent of total budget
1872	8.5	26.0	100.0	1912	49.0	159.0	4.0
1873	5.0	15.3	17.0	1913	54.0	174.0	6.0
1874	5.0	15.3	13.0	1914	54.0	172.0	5.0
1875	5.0	15.3	21.0	1915	45.0	139.0	4.0
1876	5.0	15.3	7.0	1916	40.0	109.0	4.0
1877	5.0	15.3	14.0	1917	42.0	93.0	3.0
1878	7.5 ²	27.8 ²	7.0 ²	1918	50.0	95.0	4.0
1879	7.5 ²	27.8 ²	7.0 ²	1919	50.0	93.0	4.0
1880	7.5 ²	27.8 ²	7.0 ²	1920	45.5	74.0	3.0
1881	7.5 ²	27.8 ²	7.0 ²	1921	45.0	86.0	4.0
1882	7.5 ²	27.8 ²	7.0 ²	1922	45.0	91.0	3.0
1883	7.5 ²	27.8 ²	7.0 ²	1923	40.0	79.0	3.0
1884	7.5 ²	27.8 ²	7.0 ²	1924	40.0	80.0	3.0
1885	7.5 ²	27.8 ²	7.0 ²	1925	38.0	75.0	2.5
1886	7.5 ²	27.8 ²	7.0 ²	1926	43.5	85.0	3.0
1887	7.5 ²	27.8 ²	7.0 ²	1927	57.0	115.0	3.0
1888	7.5 ²	27.8 ²	7.0 ²	1928	77.0	153.0	4.0
1889	20.0	77.0	7.0	1929	108.0	213.0	5.0
1890	20.0	79.0	7.0	1930	108.0	219.0	5.0
1891	20.0	80.0	6.0	1931	172.0	384.0	6.0
1892	20.0	83.0	6.0	1932	300.0	747.0	12.0
1893	13.0	53.0	4.0	1933	200.0	509.0	10.0
1894	22.5	93.0	6.0	1934	173.0	410.0	7.5
1895	22.5	94.0	8.0	1935	127.0	298.0	9.5
1896	22.5	102.0	6.0	1936	168.0	393.0	10.5
1897	22.5	102.0	6.0	1937	172.0	387.0	11.0
1898	22.5	98.0	5.0	1938	262.0	597.0	13.0
1899	22.5	96.0	5.0	1939	338.0	782.0	16.5
1900	26.7	108.0	6.0	1940	329.5	751.0	15.0
1901	36.0	148.0	7.0	1941	372.0	788.0	16.0
1902	36.0	142.0	6.0	Totals	4,452.2	11,414.3	
1903	36.0	140.0	7.0	Average annual expenditure	63.6	163.5	
1904	36.0	139.0	5.5	Average annual share of total Fisheries Service budget devoted to Division of Scientific Inquiry			8.3
1905	39.0	145.0	5.0				
1906	39.0	142.0	5.0				
1907	39.0	137.0	6.0				
1908	39.0	138.0	5.5				
1909	44.0	150.0	5.0				
1910	44.0	146.0	6.0				
1911	49.0	164.0	6.0				

¹See Table 2 for sources.

²Estimated.

products for the benefit not only of the primary and secondary producers, but of the retailers and the public as well. Technological advice and research attended all three endeavors.

Fishermen were assisted in the location and capture of their quarry by many means. Chief among these, aside from the obvious benefits of sound conservation methods, were the location and reporting of new fishing areas by the Fisheries Service's research vessels. In 1920, successful experiments in the use of aircraft for this purpose were carried out (Bureau of Fisheries, 1921b). The tools of the fishermen also received constant attention. Innovations in gill nets, trawls, and seines were promoted, and the preservation of nets, an expensive part of the commercial

fisherman's gear, was the subject of frequent research.

Methods favorable to one form of fishing were sometimes found to be injurious to others. For example, a special investigation of the beam (or otter) trawl found that these rigs, while excellent for catching bottom feeders, sometimes injured shellfish grounds (Bureau of Fisheries, 1916).

Service to processors of aquatic products consisted of a broad effort to prevent the excessive waste of nutritional material, and to raise the sporadically low prices in the fresh fish markets caused when catches were in excess of local or regional demand. Work here centered on refrigeration and packaging techniques that would make the catch available for later consumption in a firmer market.



Gloucester Station Hatchery, Mass., in 1891, courtesy of the National Archives.

Table 4.—Expenditures of the Federal Fisheries Service for the Division of Fisheries, fiscal years 1872 through 1941¹ (amounts in thousands of dollars).

Fiscal year	Fiscal year expenditures	1958 dollars ²	Percent of total budget	Fiscal year	Fiscal year expenditures	1958 dollars ²	Percent of total budget
1872				1912	24.0	77.0	2.0
1873	3.5 ²	10.7 ²	1.0 ²	1913	24.0	77.0	2.5
1874	3.5 ²	10.7 ²	1.0 ²	1914	24.0	76.0	2.0
1875	3.5 ²	10.7 ²	1.0 ²	1915	7.5	23.0	1.0
1876	3.5 ²	10.7 ²	1.0 ²	1916	7.5	20.0	1.0
1877	3.5 ²	10.7 ²	1.0 ²	1917	7.5	17.0	1.0
1878	3.5 ²	10.7 ²	1.0 ²	1918	7.5	14.0	1.0
1879	3.5 ²	10.7 ²	1.0 ²	1919	7.5	13.0	1.0
1880	3.5	13.0	2.0	1920	15.0	24.0	1.0
1881	3.5	13.0	3.0	1921	7.5	14.0	1.0
1882	3.5	13.0	1.0	1922	20.0	40.0	1.5
1883	3.5	13.0	1.5	1923	20.0	39.0	1.5
1884	3.5	13.0	1.0	1924	20.0	40.0	2.0
1885	3.5	13.0	1.0	1925	26.0	51.0	2.0
1886	3.5 ²	13.0 ²	1.0 ²	1926	25.5	50.0	2.0
1887	3.5 ²	13.0 ²	1.0 ²	1927	25.0	50.0	1.0
1888	3.5 ²	13.0 ²	1.0 ²	1928	25.0	50.0	1.0
1889	10.0	39.0	3.5	1929	55.0	109.0	2.5
1890	10.0	39.0	3.0	1930	54.0	109.0	2.0
1891	20.0	80.0	6.0	1931	87.0	194.0	3.0
1892	20.0	83.0	6.0	1932	117.0	290.0	5.0
1893	15.0	61.0	4.0	1933	96.0	244.0	5.0
1894	20.5	89.0	5.0	1934	78.0	185.0	3.0
1895	18.0	81.0	6.0	1935	57.0	134.0	4.0
1896	20.0	90.0	5.0	1936	61.0	142.0	4.0
1897	20.0	91.0	5.0	1937	62.0	139.0	4.0
1898	20.0	88.0	5.0	1938	74.0	168.0	4.0
1899	20.0	85.0	4.0	1939	84.0	194.0	4.0
1900	20.0	82.0	4.0	1940	80.0	182.0	4.0
1901	23.0	94.0	5.0	1941	151.0	319.0	6.5
1902	23.0	90.0	4.0	Totals	1,886.0	5,157.9	
1903	23.0	89.0	5.0	Average annual expenditure	26.94	73.68	
1904	23.0	89.0	3.5	Average annual share of total fisheries service budget devoted to Division of Fisheries			2.8
1905	25.0	93.0	3.5				
1906	25.0	91.0	3.5				
1907	25.0	87.0	4.0				
1908	25.0	88.0	3.5				
1909	25.0	85.0	3.0				
1910	25.0	83.0	3.0				
1911	25.0	85.0	3.0				

¹See Table 2 for sources.

²Estimated.

Waste was combated by developmental work on fish meals and fish "flour" which could be used in commercial fertilizers and livestock feeds. The success of packaged fish in the consumer market, after its introduction in 1922, stimulated efforts to find byproducts because more nutritional material was thrown away in the filleting process than had been discarded when the bulk of the catch was sold fresh. Through byproduct development, canners were also urged to prevent waste. A laboratory for such experiments was set up by the service at Gloucester, Mass., in 1931.

Marketing Efforts

The Division of Fisheries' effort to assist in the marketing of aquatic products began before World War I, but it gained its greatest stimulation from the temporary food shortages of that period. A pre-war example was the conversion of the commercially worthless and highly predatory dogfish, *Squalus* spp., a small shark, into a modestly priced and modestly saleable item under the less disturbing name of grayfish. During the war, the public was treated to cooking demonstrations and urged to consume such unfamiliar foods as whale steaks. Similar efforts were revived and used during the Great Depression, along with more sophisticated marketing tools like retail surveys, the encouragement of cooperative marketing associations, and a "Fishery Market News Service." Pharmacological products from fish liver oils were also promoted.

In an industry comprising numerous lightly capitalized operators, the Division of Fisheries became, in effect, a hard-working trade association for widely dispersed interests much in need of such an organization. In 1937, the year that a fishery committee was added to the National Association of Marketing Officials, fisheries products received their first price support subsidies in the amount of \$2 million. It was ironic that the supply of fisheries products, so carefully fostered by the government, exceeded public demand. Per-capita consumption of fish by the American public in the 1930's approximated 13 pounds

Table 5.—Expenditures of the Federal Fisheries Service for the Division of Fish Culture, fiscal years 1873 through 1941¹ (amounts in thousands of dollars).

Fiscal year	Fiscal year expenditures	1958 dollars ²	Percent of total budget	Fiscal year	Fiscal year expenditures	1958 dollars ²	Percent of total budget
1873	25.0	76.5	83.0	1912	738.0	2,389.0	67.0
1874	32.5	99.0	85.0	1913	579.0	1,861.0	60.0
1875	17.5	54.0	75.0	1914	635.0	2,022.0	59.0
1876	65.0	199.0	92.0	1915	622.0	1,921.0	60.0
1877	30.0	92.0	83.0	1916	657.0	1,795.0	60.0
1878	90.0 ²	275.2 ²	93.5 ²	1917	675.0	1,496.0	61.0
1879	45.0 ²	166.6 ²	88.0 ²	1918	756.0	1,440.0	60.0
1880	95.0	352.0	69.0	1919	666.0	1,237.0	56.0
1881	97.0	359.0	85.0	1920	801.0	1,123.0	61.0
1882	150.0	556.0	50.0	1921	661.0	1,264.0	54.0
1883	157.0	583.0	67.0	1922	745.0	1,509.0	56.0
1884	185.5	687.0	85.0	1923	703.0	1,384.0	54.0
1885	202.0	748.0	80.0	1924	650.0	1,298.0	53.0
1886	196.0	725.0	76.0	1925	686.0	1,342.0	44.0
1887	185.0	685.0	71.0	1926	809.0	1,577.0	51.0
1888	194.0	719.0	76.0	1927	922.0	1,844.0	49.0
1889	178.0	688.0	62.0	1928	1,000.0	1,984.0	48.0
1890	248.0	978.0	85.0	1929	1,104.0	2,182.0	50.0
1891	254.0	1,016.0	72.0	1930	1,038.0	2,105.0	46.0
1892	264.0	1,095.0	73.0	1931	1,363.0	3,042.0	51.0
1893	252.5	1,030.0	71.0	1932	1,496.0	3,722.0	42.0
1894	245.0	1,065.0	63.0	1933	894.0	2,274.0	45.0
1895	184.0	809.0	58.0	1934	809.0	1,916.0	45.0
1896	278.0	1,258.0	68.0	1935	586.0	1,375.0	44.0
1897	245.0	1,105.0	63.0	1936	648.0	1,518.0	41.0
1898	265.0	1,155.0	63.0	1937	685.0	1,539.0	43.0
1899	331.0	1,402.0	67.0	1938	947.0	2,157.0	47.5
1900	331.0	1,342.0	70.0	1939	886.0	2,052.0	43.0
1901	353.0	1,440.0	71.0	1940	966.0	2,201.0	43.0
1902	404.0	1,592.0	71.0	1941	1,000.0	2,119.0	43.0
1903	339.0	1,318.0	68.0	Totals	34,879.0	94,327.3	
1904	460.0	1,769.0	70.0	Average annual expenditure	505.5	1,367.0	
1905	503.0	1,891.0	71.0	Average annual share of total Fisheries Service budget devoted to Division of Fish Culture			63.6
1906	517.0	1,902.0	73.0				
1907	478.0	1,691.0	69.0				
1908	504.0	1,792.0	72.0				
1909	586.0	2,013.0	69.0				
1910	519.0	1,741.0	71.0				
1911	647.0	2,171.0	75.0				

¹See Table 2 for sources.

²Estimated.

per year as opposed to 133 pounds for beef (U.S. Department of Commerce, 1935, 1937; U.S. Congress, 1937).

The Division of Fisheries received by far the smallest share of the annual budget of the Fisheries Service, even when contributions from other segments of the Service are taken into account. Averaging 3% of the budget from 1880 through 1941, it received a high of 6.5% in 1941 and frequently less than 1% in other years (Table 4).¹⁰ Total appropriations over the 70-year period approximated \$5.2 million, an annual average of \$75,000 or only \$52,000 if the Depression years are excepted.

Considering the Division's accomplishments in the light of its expenditures, the conclusion seems to be in-

capable that it was remarkably efficient. The statistical inquiries, as they matured in accuracy and quantity and reflected cooperation with state and private sources, were an indispensable ingredient in the accomplishment of the basic purposes of the Fisheries Service.

Division efforts for the fisheries industries were sometimes more praiseworthy in conception than in performance, however. But the cause was usually a lack of cooperation on the part of state governments and the industry. In the area of marketing assistance the obstacle was simply the unwillingness of the public to eat more fish. The poor results in this area suggest that the tax dollar was no more, and perhaps less, effective than the dollar of the private entrepreneur in the uncertain business of influencing consumer preferences.

Table 6.—Expenditures of the Federal Fisheries Service for the Alaska Fisheries Service, fiscal years 1912 through 1941¹ (amounts in thousands of dollars).

Fiscal year	Fiscal year expenditures	1958 dollars	Percent of total budget
1912	142.0	458.0	13.0
1913	143.0	423.0	15.0
1914	164.0	522.0	15.0
1915	136.0	425.0	13.0
1916	123.0	335.0	11.0
1917	150.0	332.0	13.0
1918	163.0	310.0	13.0
1919	239.0	444.0	20.0
1920	187.0	301.0	14.0
1921	224.0	427.0	18.0
1922	230.0	466.0	17.0
1923	265.0	521.0	20.0
1924	235.0	469.0	19.0
1925	358.0	701.0	23.0
1926	405.0	790.0	26.0
1927	482.0	965.0	26.0
1928	507.0	1,006.0	24.0
1929	501.0	990.0	23.0
1930	648.0	1,315.0	29.0
1931	593.0	1,324.0	22.0
1932	545.0	1,356.0	22.0
1933	456.0	1,160.0	23.0
1934	415.0	983.0	18.0
1935	313.0	735.0	23.0
1936	338.0	792.0	21.0
1937	353.0	793.0	22.0
1938	349.0	795.0	17.5
1939	345.0	799.0	17.0
1940	343.0	782.0	15.0
1941	359.0	761.0	16.0
Totals	9,711.0	21,480.0	
Average annual expenditure	323.7	716.0	
Average annual share of total Fisheries Service budget devoted to Alaska Division			19.0

¹See Table 2 for sources. These figures include expenditures for the construction and crews of vessels used by the Alaska Fisheries Service.

The maintenance of an important national food resource is clearly a worthy object of government. The Division of Fisheries made significant strides toward its attainment.

Fish Culture Operations

The artificial propagation of commercial and game fish and other aquatic animals, though a belated addition to Federal responsibility, employed more men and money than any other activity of the Fisheries Service. Over 65% of all agency expenditures (in actual dollars) from 1872 through 1941 were specifically allocated to this program (Table 5). Indirect fish culture appropriations went to the Division of Scientific Inquiry for experimen-

¹⁰Values in this paragraph are in 1958 dollars.

tal fish culture and to related vessel costs.¹¹ Set apart as a division in 1884, fish culture was justified by two mutually supporting sets of assumptions, one positive, the other negative.

The positive argument rested on faith in the largely untested utility of fish culture methods for maintaining the natural supply of fishes, "repairing the effects of past improvidence," and for increasing the supply of aquatic food to meet the needs of an expanding population. Bold faith was clearly needed and fortunately was available because of the scientific enthusiasm of the 1870's.

Prior to 1872 only six important species of fish had been successfully hatched in the United States by artificial means. The first was the brook trout, *Salvelinus fontinalis*, in 1853. By 1882, 23 species had been added to the

list through experiments dominated by Fish Commission scientists, but much remained to be learned before efficient propagation methods and safe transportation of eggs and fry would make massive stocking possible.

There was no precedent for attempts to augment the supply of such pelagic marine fishes as the Atlantic cod, *Gadus morhua*, by artificial propagation, and few data supported the hope that the survival ratio of fish planted in marine or freshwater habitats would justify the effort. To allay doubts in high places, Baird arranged Presidential visits to hatching facilities near Washington and, on at least one occasion, decorated the rooms of the House and Senate Appropriations Committees with displays of live young cod (U.S. Commission of Fish and Fisheries, 1879-80; Goode, 1884).

On the negative side, the activities of the Division of Fish Culture were justified by the assumption that fully

adequate state regulation of destructive fishing methods was politically unfeasible, and that state or private stocking programs could not be expected to donate their output to the general public.

The interstate fisheries dispute in New England that engendered the Fish Commission itself was good evidence of the existing intransigence of most state legislatures in fishery matters. It was this consideration which led Commissioner Marshall MacDonald to write to Sen. Levi P. Morton (R-N.Y.), President of the Senate: "Men, however public spirited, will not sow the seed of the harvest that all men may gather. Our lakes and rivers and coast waters must be farmed by the Government for the general use and under such regulations as will establish and maintain the largest production¹²" (U.S. Commission of Fish and Fisheries, 1892-93).

Over the years it became apparent, however, that while the scientists tended to be overly optimistic about the potential of propagation, those who agreed with Commissioner MacDonald tended to take too dark a view of the motives and abilities of state legislators. Actually, cooperation with state agencies was one of the cardinal tenets of the Federal Fisheries Service.

Indeed, the period of the most rapid growth for state fish commissions corresponded with the first decade of the Federal Service. In 1872 only 12 states had any such agencies. But by 1882, fully 39 states had fishery agencies which spent an estimated aggregate of \$121,000, as compared with a Federal fisheries outlay of \$155,000¹³ (U.S. Congress, 1880-81, 1882-83; Goode, 1884).

Although awakened to the merits of conservation work by the Federal example, the new state agencies often functioned as useful political channels through which efforts were made to bring Federal hatcheries and fish into the

¹¹ The origins of the Division of Fish Culture are mentioned earlier in the text.

Table 7.—Expenditures of the Federal Fisheries Service for vessel construction, maintenance, and crews, fiscal years 1880 through 1941¹ (amounts in thousands of dollars).

Fiscal year	Fiscal year expenditures	1958 dollars ²	Percent of total budget	Fiscal year	Fiscal year expenditures	1958 dollars ²	Percent of total budget
1880	57.5	213.0	37.0	1915	141.0	434.0	14.0
1881	13.0	47.0	11.0	1916	149.0	407.0	14.0
1882	145.0	537.0	48.0	1917	147.0	325.0	13.0
1883	70.0	259.0	30.0	1918	183.0	348.0	14.0
1884	56.0	206.0	22.0	1919	164.0	304.0	14.0
1885	45.0	167.0	18.0	1920	183.0	299.0	14.0
1886	59.0	219.0	23.0	1921	186.0	355.0	15.0
1887	72.5	269.0	28.0	1922	175.0	355.0	13.0
1888	56.5	209.0	22.0	1923	161.0	317.0	12.0
1889	45.0	173.0	16.0	1924	171.0	341.0	14.0
1890	10.0	39.0	3.0	1925	184.0	361.0	12.0
1891	54.0	216.0	15.0	1926	187.0	365.0	12.0
1892	55.0	228.0	15.0	1927	246.0	492.0	13.0
1893	70.0	281.0	19.0	1928	365.0	724.0	17.0
1894	42.0	183.0	11.0	1929	276.0	546.0	12.0
1895	42.0	185.0	13.0	1930	426.0	864.0	19.0
1896	42.0	190.0	10.0	1931	315.0	703.0	12.0
1897	55.0	248.0	18.0	1932	317.0	788.0	13.0
1898	66.0	289.0	16.0	1933	200.0	509.0	10.0
1899	75.0	318.0	15.0	1934	200.0	474.0	11.0
1900	42.0	170.0	9.0	1935	135.0	333.0	10.0
1901	46.5	190.0	9.0	1936	145.0	340.0	9.0
1902	53.0	203.0	9.0	1937	160.0	360.0	10.0
1903	46.5	181.0	9.0	1938	168.0	383.0	8.0
1904	87.0	333.0	13.0	1939	231.0	535.0	11.0
1905	81.0	305.0	11.0	1940	214.0	487.0	9.5
1906	70.0	257.0	10.0	1941	240.0	508.0	10.0
1907	95.0	337.0	14.0	Totals	8,010.5	21,006.0	
1908	79.0	281.0	11.0	Average annual expenditures	129.2	338.8	
1909	137.0	472.0	16.0	Average annual share of total fisheries service budget devoted to vessels			14.3%
1910	84.0	283.0	11.0				
1911	83.0	278.0	10.0				
1912	91.0	293.0	8.0				
1913	85.0	274.0	9.0				
1914	131.0	416.0	12.0				

¹ See Table 2 for sources. These figures include vessel costs for the Alaska Fisheries Service.

¹² The interstate fisheries dispute in New England is discussed earlier in the text.

¹³ The costs of the steamer *Albatross* have been deleted from the Federal fisheries expenditures for 1882 to make the comparison with state expenditures more meaningful.

EAT FROZEN FISH

FISH HAS A HIGH FOOD VALUE

IT CONTAINS AS MUCH BODY-BUILDING MATERIAL AS BEEF-STEAK and is as readily digestible

FROZEN FISH are as **WHOLESOME** and **NUTRITIOUS** as fresh fish

BUY THEM FROZEN, THAW IN A REFRIGERATOR or other cool place, and cook promptly

ASK FOR LEAFLET GIVING FURTHER INFORMATION

DEPARTMENT OF COMMERCE
BUREAU OF FISHERIES
WASHINGTON

MRS. EVELENE SPENCER

Fish Cookery Expert, U. S. Bureau of Fisheries, Author of "Fish Cookery"



Says—

*Eat more Fish for your health's sake.
Get acquainted with cheaper kinds and use more of them.
Use Smoked and Salt Fish for breakfast.
Use Frozen Fish when Fresh Fish is scarce or out of season.
Use more Shell-Fish—America produces finest in the world.*

Separate Fish from Friday

—Make **TUESDAY** a Fish Day as well

EAT MORE FISH

—A Real Health Food

ASK US FOR A RECIPE BOOK

GRAYFISH

RICH-FLAVORED
NUTRITIOUS
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THE
NEWEST
SEA-FOOD

RECOMMENDED BY
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ASK FOR COOK BOOK

WHALE MEAT

THIS IS MEAT—NOT FISH
ECONOMICAL AND EXCELLENT

For Soups, Stews, Curries, and Roasts

RECOMMENDED BY

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DEPARTMENT OF COMMERCE

ASK FOR RECIPES

EAT MORE FISH!

FISH IS MEAT and has a **HIGH FOOD VALUE**.

Analysis shows that fish meat contains as much **BODY-BUILDING FOOD** as beefsteak.

Experiments show that fish is as **READILY DIGESTED** as are other meats.

You could replace all other meats with fish every day in the year without ill effects. There are more possibilities of increase in the meat supply by the fisheries than by any other one industry. The demand in the past has not equaled the supply.

EAT FRESH FISH if you are near the source of fresh fish, but don't expect to buy at a low price fresh fish that have to be shipped by express for long distances on ice. Consume your locally-caught fishes and don't all use the same kinds. The cheapest is often as good as or better than the dear.

EAT SALT FISH wherever you are. Write the Bureau of Fisheries for recipes for preparing salt fish for the table. If you eat meat for breakfast make it **SALT HERRING, SALT MACKEREL**, or other salt fish. Salt fish are good eating if you prepare them properly for the table. Do that.

EAT SMOKED FISH. There is nothing better than fish prepared by this old-fashioned method. Smoked herring, smoked eels, smoked **BOWFIN**, smoked **SHARK**, smoked **CARP**. The three last mentioned are just being introduced to the market. Make them go! Write for recipes for preparing smoked fish for the table.

Don't let Friday be the only **FISH DAY**. Eat more fish **MORE DAYS A WEEK**. Don't stand back on disagreeable **NAMES** or ungainly **APPEARANCES**.

PREJUDICE IS AN EXPENSIVE LUXURY. A shark would not taste any better if called by another name; it tastes good as it is. **CARP** is good eating and nutritious. You will not find any fish on the market that is not fit to eat if it is in good condition. The best test of a fresh fish is not its **NAME** but its **FRESHNESS**.

LOOK OUT FOR NEW FISH! They are coming! **BOWFIN, GRAYFISH, BURBOT, GOOSEFISH, SHARK, SKATE, SAHLEFISH, GROUPE**.

PRESERVE FISH IN THE HOME. Small-pressure canners are already in use by thousands of people. Put up a supply of fish when you can get them cheap. Can the roes, too; they are especially nutritious.

EAT FISH—CULTIVATE THE TASTE—GET THE HABIT!

For advice, information, recipes, etc., write

U. S. BUREAU OF FISHERIES, DIVISION F,
WASHINGTON, D. C.

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WASHINGTON, D. C.

Fisheries Service fish promotional posters,
courtesy of the National Archives.

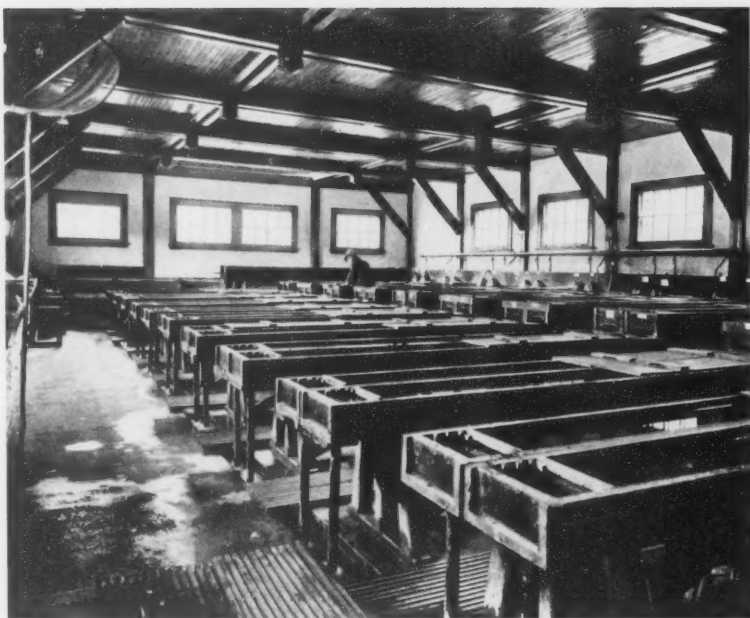
states. There were repeated examples, especially prior to World War I, of state resentment of Federal displeasure, expressed or implied, with state fisheries regulations and programs. The Federal Fisheries Service, not above showing its annoyance, urged the states to take a greater share in conserving their aquatic resources (U.S. Department of Commerce and Labor, 1906-07).

By 1936, state review of requests for fish made by individuals to the Federal Fisheries Service were "such a routine matter as to require no special comment" in the Federal Fish Commissioner's annual report (U.S. Department of Commerce, 1936). Those state reviews were made to avoid duplication, enhance efficient allocation, and coordinate state and Federal fish distribution to cut costs and give faster service.

Occasional doubts were expressed about the propriety of spending public money for the propagation and distribution of game species. The recreational motive for fishing, stressing the sport of capturing the fish rather than the intrinsic value of the fish caught, was recognized as being somewhat at odds with the commercial orientation of the Fisheries Service. Nevertheless, game fish could be considered as a valuable food source, particularly such a dual-purpose species as the Atlantic salmon, *Salmo salar*, and the Division quietly and consistently gave a small percentage of its budget to their propagation. The rearing of trout was among the earliest of the Division's fish culture efforts¹⁴ (Herbert, 1850; U.S. Commission of Fish and Fisheries, 1903-04).

Game Fish Distribution

In 1914, Commissioner Hugh M. Smith cautiously noted that the Federal distribution of game species was "valuable as an incentive to private fish culture and for maintenance in public waters of a supply of fishes that



Interior of a trout hatchery (U.S. Department of Commerce and Labor, 1908).

may be taken by anglers." By 1934, all semblance of sensitivity to the issue had vanished, and the Fisheries Service, defending the modern view of recreation as a worthy object of public expenditures, not only expanded its hatching operations to stock Federally owned parks and forests, also inaugurated an Anglers' Service for the purpose of dispensing sport fishing advice to the public. In 1941, the first Director of the new Fish and Wildlife Service, Ira N. Gabrielson, broadened the definition of the "specific major objective" of the agency to include, simply, "an abundance of wild things" (Bureau of Fisheries, 1915; U.S. Department of Commerce, 1934; U.S. Department of the Interior, 1941).

Operational methods of the Division of Fish Culture were designed to perform three basic functions: collection and fertilization of eggs; hatching and rearing of fry; and distribution of fertilized eggs, fry, and fingerlings to stocking locations or cooperating hatcheries. Although mature fish were obtained for restocking by the practical expedient

of seining them from landlocked backwaters where they were deposited by spring floods, such operations were only a minor activity of the Division.

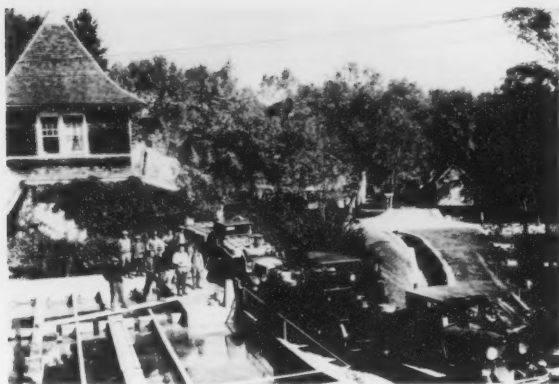
Execution of the first two basic functions of propagation work led the Division into the construction and operation of fish culture stations. By 1941, these could be found at 110 locations scattered over nearly all of the states and the Territory of Alaska.

The number of stations grew early with the demand for their output, and as early as 1875 applications for fish had been received from all of the states and four territories. Requests for stations themselves were also abundant and frequently traceable to Members of Congress who desired to ingratiate themselves with their constituents. The result was that the demand for stations "... from Congressional districts where the waters were suitable only for carp and catfish was as vociferous as if they were the normal habitat for trout and bass" (U.S. Commission of Fish and Fisheries, 1874-75; Dall, 1915; U.S. Department of the Interior, 1940).

¹⁴Over 200,000 trout were distributed by the Federal Fisheries Service between 1871 and 1882 out of a total of all distribution in the same decade of over 341 million—less than one tenth of 1%.



Spearfish, S.D., hatchery raceways in 1899, courtesy of the U.S. Fish and Wildlife Service, Booth Historic Fish Hatchery.



Spearfish, S.D., fish stocking convoy in 1929, courtesy of the U.S. Fish and Wildlife Service, Booth Historic Fish Hatchery.



U.S. Fish Commissioner Henry O'Malley stocking fish in the Potomac River tidal basin, Wash., D.C. (ca. 1920's), courtesy of the Library of Congress.

Fish Hatcheries

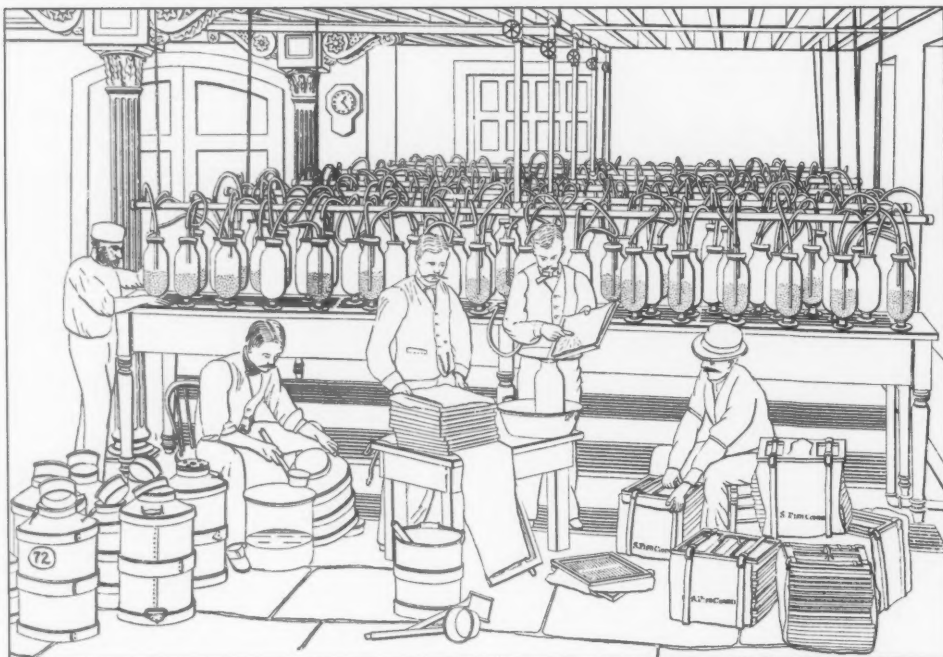
Fish culture stations were either permanent or auxiliary. Permanent stations were characteristically equipped for hatching and rearing and required a considerable investment in buildings, ponds, and pumping equipment to control the flow of water from a carefully selected source. The average cost (in 1958 dollars) for such a facility, including the preliminary investigation and land, ran about \$87,000. Annual salaries for operating personnel amounted to about \$15,000. About 3 years were required to put a station in operating condition. Normally built in

remote stream valleys, these stations were prone to damage by flood and fire, a condition well attested by numerous deficiency appropriations for the purpose of major repairs (U.S. Congress, 1893-94, 1894-1895, 1895-96, 1897, 1897-98).

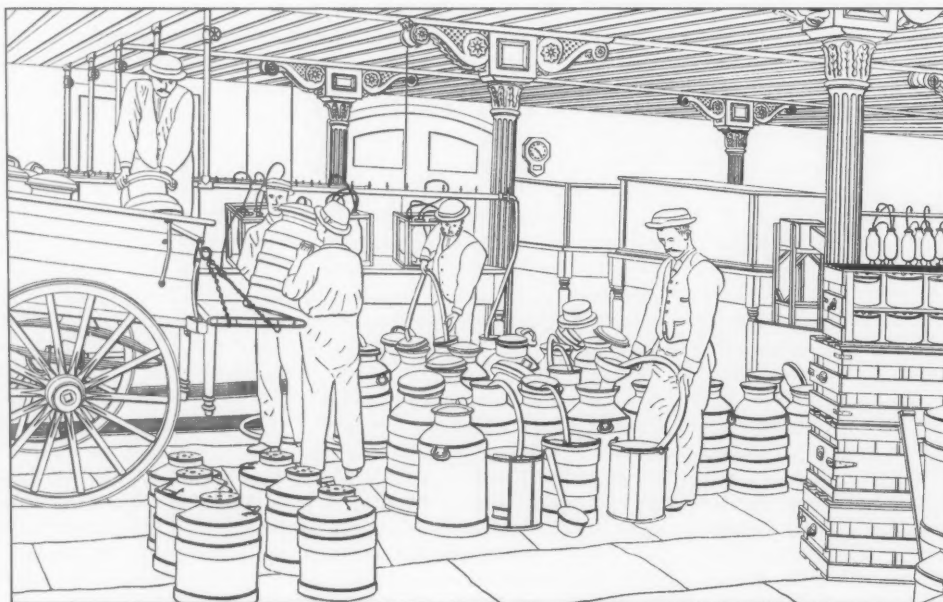
The auxiliary stations were less elaborate facilities for the collection, fertilization, and occasionally, the hatching of eggs. Their locations were often changed to exploit the best supply of spawning fish, and their number varied from year to year. In 1917, for example, along with 55 permanent stations, the Division operated 19 "sub-hatcheries" and 74 egg collecting stations. Operated

by employees-at-large along with regular station personnel, auxiliary stations were carried for accounting purposes within the divisional budget and did not appear in the annual appropriations acts (Bureau of Fisheries, 1919).

Some auxiliary facilities were completely mobile, and the ingenuity of their outfitting and employment was a credit to the common sense of the Division employees. The *Fish Hawk* and the *Grampus* were designed to accomplish fertilization and hatching afloat, and the techniques of at-sea propagation were eventually refined to the point where commercial fishing smacks with properly equipped Division teams aboard



"Canning" shad fry for transportation and receiving eggs and transferring them to holding jars at the Fisheries Service Central Hatching Station (U.S. Commission of Fish and Fisheries, 1882-83).



Loading a shipment of shad fry (U.S. Commission of Fish and Fisheries, 1882-83).

could distribute millions of fertilized eggs directly over the fishing grounds in the course of a regular fishing cruise.

Shad Batteries

Hatcheries mounted on barges, called "shad batteries," were towed to favorable estuarine and river sites during shad, *Alosa sapidissima*, runs, and a specially equipped railroad car was sometimes used for the same purpose where the tracks ran sufficiently close to shad rivers (U.S. Commission of Fish and Fisheries, 1881-82 and 1884-85).

In all propagation operations, whether at permanent or auxiliary stations, the initial requirement was adequate quantities of eggs and milt from live or freshly killed fish. The Division of Fish Culture was obliged to do its own fishing in many instances, but it often saved money by getting supplies directly from commercial fresh fish markets, such as the one at Fulton Street in New York City, and from numerous smaller coastal docks.

In some cases the Division paid fishermen for bringing them the necessary breeders. This procedure sometimes became expensive. Live Atlantic salmon cost \$6-7 each in inflationary 1920. In 1914 the Division inaugurated a money-saving policy by exchanging a "stripped" lobster, *Homarus americanus*, for each egg-bearing one brought in, rather than continuing to pay cash for egg-bearers and releasing them "stripped," only to be promptly caught again and resold by the alert lobstermen (Bureau of Fisheries, 1915, 1921c).

The availability of spawning fish was the single most important factor affecting fluctuations in the annual output of the fish culture stations, but the routine work of propagation was also interrupted by unexpected hazards. Wilderness living, particularly in the early days, provided special problems.

The Baird Hatchery

For example, the Fish Commission's first salmon hatching station, constructed on the banks of the McCloud River in northern California in 1872, was 25 miles from the nearest village and 50 miles from the nearest railroad

and sawmill. Livingston Stone, director of the station, managed to befriend the local Indians but reported that, "Even now they are not slow to say to the white stranger, 'These are my lands,' and, 'These are my salmon'..." Cataloging the difficulties of life on the McCloud in a later report, Stone listed tarantulas, scorpions, rattlesnakes, Indians, panthers, and threats of murder. In 1877 a squad of soldiers was assigned to protect the station against poachers (Indian and white) and angry squatters (Stone, 1872-73; U.S. Congress, 1877-78; U.S. Commission of Fish and Fisheries, 1879-80).

Nature's violence also frustrated fish culture work through almost yearly washouts of fish-collection dams in some western rivers. In 1888 the *Grampus* was abandoned in heavy weather off Nantucket. In 1912 the eruption of Mount Katmai covered a Federal salmon hatchery in Alaska with nearly a foot of volcanic ash (U.S. Commission of Fish and Fisheries, 1889-90; Evermann, 1914). Nor were the other Divisions immune from disaster. In 1906 the commanding officer of the *Albatross* [LeRoy Mason Garrett] was drowned when he was washed overboard southwest of Hawaii (U.S. Department of Commerce and Labor, 1907).

The third basic function of the Division of Fish Culture was the distribution of fertilized eggs, fry, and fingerlings to stocking locations, co-operating state and private hatcheries, and even to individuals. The delivery of freshwater species, often in small lots, required complex traffic scheduling and climatically controlled equipment. Marine and anadromous species, on the other hand, were normally planted at the hatching or fertilization sites and required no transportation unless part of an acclimatization project. Until the 1930's when trucks took over most of the work, the railroads made continental fish distribution possible; for overseas fish shipments, steamships were used.

Railroad Fish Cars

The Fish Commission purchased its first specially constructed distribution

railroad car in 1881. Earlier delivery requirements were sufficiently small to permit Commission messengers, traveling in regular railroad baggage cars with a few milk cans of fish, to accomplish most delivery assignments.

Cooperation of the railroads was excellent and took the form of free or minimal charge service. This included stopping regularly scheduled trains at waterside stocking locations; the practice seemed to entertain rather than irritate the passengers in those less hurried times (U.S. Commission of Fish and Fisheries, 1881-82).

As requests for fish grew, so did the realization that large-scale stocking would enhance the survival of stocked fry and fingerlings. This reasoning assumed that a certain minimum number of the young fish would fall prey to natural enemies, and that it was therefore necessary to stock in excess of that minimum to ensure success. The combination of demand and theory made the use of special cars imperative. In 1889 a specially designed distribution car cost \$8,000 and carried a crew of five men, including a cook (U.S. Congress, 1888-89b).

The complexity of handling many small orders was demonstrated by the make-up of one carload of carp, for distribution in Texas in 1881. The car carried fish for 950 separate orders in 40 large cans of 100-150 fish per can, in 288 small pails packed in 18 crates containing 360 fish per crate, and in three large crates which held 400 fish apiece (U.S. Commission of Fish and Fisheries, 1881-82).

In the relatively typical year of 1907, the Division distributed by rail approximately 10% of its output of 2.5 billion fertilized eggs, fry, and fingerlings. Six cars covered 83,840 miles, while detached messengers traveled 263,196 miles, a total of over 347,000 miles. In the same year the Hepburn Act and various state railroad regulations effectively ended the free and below-cost service to which the Division had become accustomed, doubling the cost of fish transportation. Combined salaries of distribution personnel were running at an annual rate of \$23,000 (U.S. Con-



Seining spawning salmon on the McCloud River, Calif., at the Baird Station (U.S. Department of Commerce and Labor, 1908).



Spawntaking operations on the McCloud River, Calif., at the Baird Station (U.S. Department of Commerce and Labor, 1908).



Baird Salmon Hatchery on the McCloud River, Calif. (U.S. Department of Commerce and Labor, 1908).



Livingston Stone,
courtesy of the California
Department of Fish and Game.

gress, 1905–06b; U.S. Department of Commerce and Labor, 1907).

The Division did not make a successful effort to share transportation costs with its clients until 1934. Previously it had delivered without cost to the closest point of rail approach. This policy fostered the view that the Division of Fish Culture was "an agency for delivering so many fish upon order, as if this were a manufactured product the ultimate disposition of which was of little interest to the manufacturer" (U.S. Department of Commerce, 1927).

Fish Rescue

Mississippi Valley fish rescue operations of the Division required only modest distribution service and were conducted by methods quite different from the basic functions of the regular fish culture stations. The collection and distribution of native food fish from overflow ponds and lakes formed during floods was begun near Quincy, Ill., in 1888. The numbers of fish seined from the backwaters of the upper Mississippi River Basin varied in proportion to the severity of the floods and to the numbers of men that the Division could afford to hire for work. In 1890 over 133,000 mature fish were taken and most were returned to the main channel (U.S. Commission of Fish and Fisheries, 1892–93).

The potential of the work was considered so promising that special stations were constructed for fish rescue operations at La Crosse, Wis., in 1905 and at Homer, Minn., in 1910. The personnel of the biological station at Fairport, Iowa, also assisted and made further use of the rescued fish as hosts to the larvae of the freshwater mussels they were attempting to propagate. An outstanding year for fish rescue work was 1922 when over 181 million fish were relocated (U.S. Department of Commerce and Labor, 1905–06; Bureau of Fisheries, 1911; U.S. Department of Commerce, 1922).

Fish rescue operations were finally abandoned in 1939 when channel improvements and flood control measures made them unnecessary. In the meantime, some fish taken by this method

were used to stock the extensive area of the Upper Mississippi Wildlife and Fish Refuge established by the Federal government in 1924 (U.S. Congress, 1923–24b; U.S. Department of Commerce, 1939).

Two-hundred Billion Fish

Utilizing the full range of methods that science, human ingenuity, and available public money provided, the Division of Fish Culture planted, or distributed for planting, the incredible number of over 200 billion fish and other aquatic animals in national and international waters from 1872 through 1940. The number of species handled, having grown to 30 near the turn of the century, leveled off at a range of 40–50 species by 1911 and continued there through 1940. Until the 1930's, more than 90% of the fish and other animals released were of commercial species as opposed to game and pond fishes. Among the most interesting programs were those involving acclimatization, the planting of species in waters where they were previously unknown. Table 8 lists annual propagation figures, and Table 9 lists representative species propagated.

The Division classified its propagation efforts into the categories of marine species, anadromous species of the Atlantic coast, interior commercial species, and miscellaneous species. The last group was later diminished by the separate classification of freshwater game fish but also included freshwater "coarse fish" like carp, sunfish, crappies, catfish, and other aquatic animals such as crustaceans, mollusks, sponges, and marketable turtles. The Pacific salmon were reported separately.

Propagation of marine species accounted for about 75% of the Division's production and was the most difficult category in which to measure results. The species involved were primarily the familiar food fishes of the North Atlantic fishing banks: cod, *Gadus morhua*; pollock, *Pollachius virens*; haddock, *Melanogrammus aeglefinus*; and such popular groundfish as halibut, *Hippoglossus hippoglossus*; and flounder, *Pleuronectes americanus*.

Table 8.—Summary of Federal Fish Culture operations, output of eggs, fry and fingerlings, fiscal years 1872 through 1941¹ (amounts to nearest million of eggs and fish).

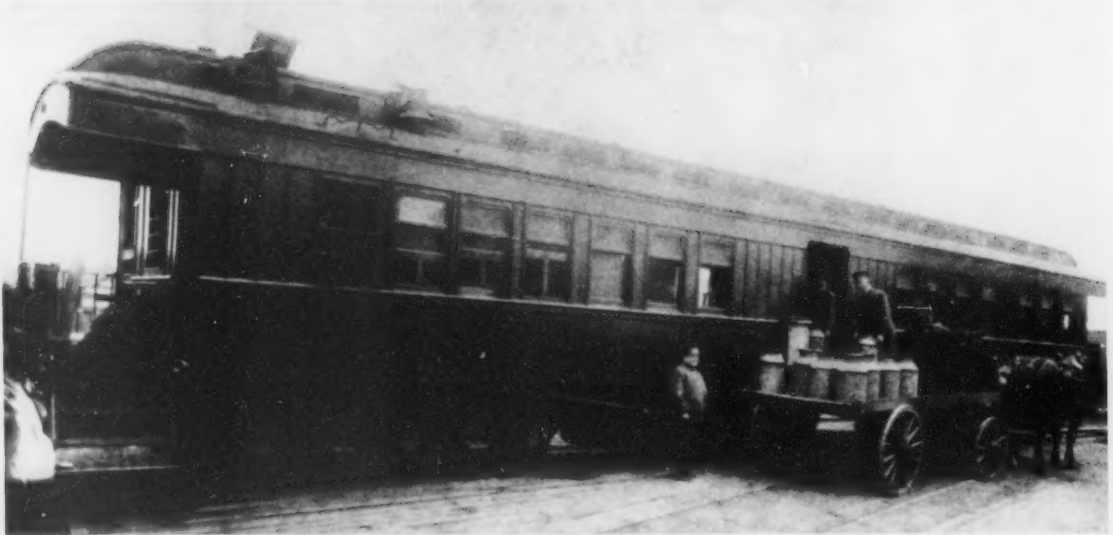
Dates	Fertilized eggs	Fry	Fingerlings, yearlings, and adults	Total
1872–1881 ²				341
1882–1892 ²				2,391
1892–1903 ²				9,291
1904–1908	2,003	8,284	54	10,341
1909–1913	2,409	15,014	115	17,538
1914–1918	1,958	20,058	424	22,440
1919–1923	5,451	18,349	1,249	25,049
1924–1928	6,801	21,463	1,149	29,413
1929–1933	13,228	21,763	1,037	36,028
1934–1938	21,845	10,020	676	32,541
1939–1941	14,119	5,935	256	20,310
Total				205,683

¹Sources for the output of the Federal propagation operations from 1904 through 1941 were the annual Reports of the Commissioner, the annual Reports of the Division of Fish Culture appended thereto, and the Statistical Digests of the Department of the Interior.

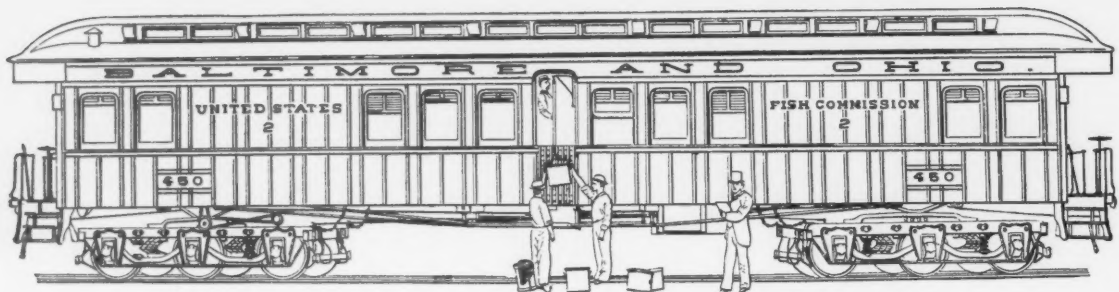
²Totals for 1872–1903 were taken from a summary table in U.S. Commission of Fish and Fisheries, Report of the Commissioner for 1903, House Doc. No. 751, 58th Cong., 2nd sess., 1903–1904, p. 28; breakdowns for eggs, fry and fingerlings are not given therein, nor do they appear in the earliest reports of the Fish Commission. The post-1903 figures, however, show the primary trends: the rise in the number of fingerlings (mostly game fish), and the increase in egg production relative to fry after 1934 (mostly cod eggs distributed on the fishing grounds).

Operating out of shore stations at Boothbay Harbor, Maine; Gloucester and Woods Hole, Mass., and directly from Fisheries Service and private vessels, the Division stocked the sea with the above species at a rate that rose to over 5 billion fish annually by 1927. Most stocking was done in the form of fertilized eggs, a form highly vulnerable to predators.

Despite these efforts, fishery statistics show that the annual catch of cod dropped from nearly 300 million pounds in 1880 to about 70 million pounds in 1941. The annual take ran between 75 million and 125 million pounds. The haddock catch, on the other hand, increased steadily from about 40 million pounds in 1880 to about 145 million pounds in 1941 (Bureau of the Census, 1949). Since similar propagation efforts were made with both species, it is realistic to assume that, while the stocking was a positive measure, fishing methods, market demand, and natural enemies were the dominant influences on the productivity of these Atlantic coast fisheries. Attempts to introduce the European sole, *Solea* sp.,



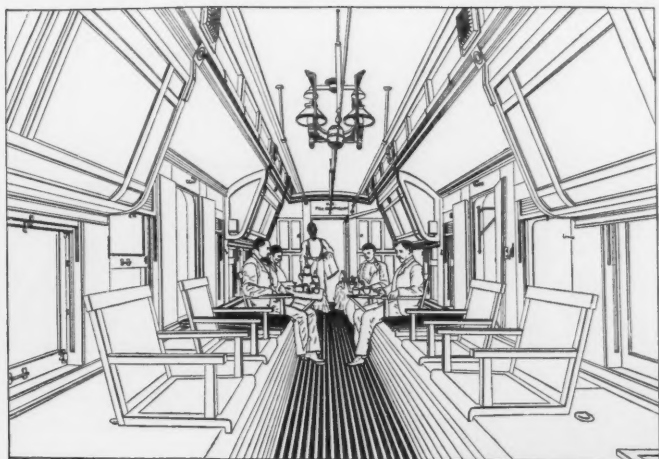
Loading cans of fish onto a U.S. Fish Commission railroad car.
courtesy of the U.S. Fish and Wildlife Service, Booth Historic Fish Hatchery.



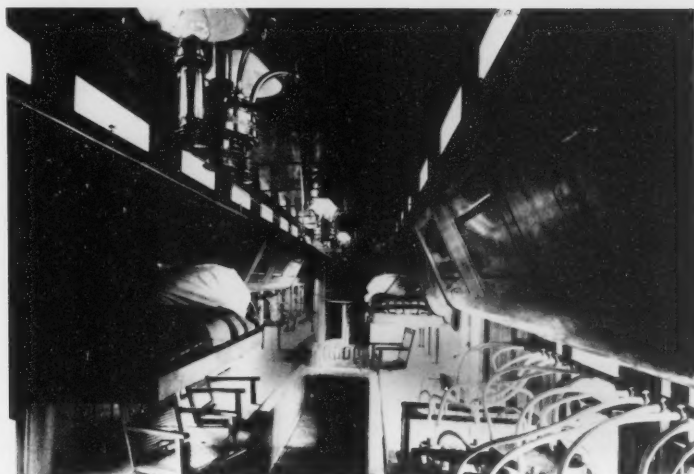
U.S. Fish Commission refrigerator car no. 2 (U.S. Commission of Fish and Fisheries, 1882-83).



Fish car interior when not in use
(U.S. Commission of Fish and Fisheries, 1882-83).



Dining arrangements (U.S. Commission of Fish and Fisheries, 1882-83).



Sleeping arrangements (U.S. Commission of Fish and Fisheries, 1882-83).



Loaded cans of fish (U.S. Commission of Fish and Fisheries, 1882-83).

Table 9.—Species of fish propagated by the Federal Fisheries Service in 1884 and 1937.¹

Species	1884	1937	Commercial	Game	Commercial and game
Bullhead catfishes (Ictaluridae)					
Flathead catfish, <i>Pylodictis olivaris</i>		X			X
Channel catfish, <i>Ictalurus punctatus</i>		X			X
Brown bullhead, <i>Ameiurus nebulosus</i>	X	X			X
Carp (Cyprinidae)					
Common carp, <i>Cyprinus carpio carpio</i>	X	X	X		
Ide, <i>Leuciscus idus auratus</i>	X		X		
Goldfish, <i>Carassius auratus</i>	X		X		
Tench, <i>Tinca tinca</i>	X		X		
Suckers (Catostomidae)					
Buffalo, <i>Ictalurus sp.</i>		X	X		
Herring (Clupeidae)					
American shad, <i>Alosa sapidissima</i>	X	X	X		
Blueback herring, <i>Alosa aestivalis</i>	X	X	X		
Salmonidae					
Vendace, <i>Coregonus albus</i>	X		X		
Lake whitefish, <i>Coregonus clupeaformis</i>	X	X	X		
Cisco, <i>Coregonus artedii</i>		X	X		
Chinook salmon, <i>Oncorhynchus tshawytscha</i>	X	X			X
Chum salmon, <i>Oncorhynchus keta</i>		X	X		
Coho salmon, <i>Oncorhynchus kisutch</i>		X			X
Sockeye salmon, <i>Oncorhynchus nerka</i>		X	X		
Steelhead trout, <i>Oncorhynchus mykiss</i>		X		X	
Atlantic salmon, <i>Salmo salar</i>	X	X			X
Landlocked salmon, <i>Salmo salar</i>	X	X		X	
Rainbow trout, <i>Oncorhynchus mykiss</i>	X	X		X	
Cutthroat trout, <i>Oncorhynchus clarkii clarkii</i>		X		X	
Brown trout, <i>Salmo trutta trutta</i>	X	X		X	
Lake trout, <i>Salvelinus namaycush</i>	X	X			X
Arctic charr, <i>Salvelinus alpinus alpinus</i>	X		X		
Brook trout, <i>Salvelinus fontinalis</i>	X	X	X		
Arctic grayling, <i>Thymallus arcticus arcticus</i>	X	X	X		
Pikes (Esocidae)					
Pike and pickerel, <i>Esox sp.</i>		X		X	
Sunfishes (Centrarchidae)					
White crappie, <i>Pomoxis annularis</i>		X			X
Largemouth bass, <i>Micropterus salmoides</i>		X		X	
Smallmouth bass, <i>Micropterus dolomieu</i>		X		X	
Rock bass, <i>Ambloplites rupestris</i>		X			X
Warmouth, <i>Lepomis gulosus</i>		X			X
Bluegill, <i>Lepomis macrochirus</i>		X			X
Green sunfish, <i>Lepomis cyanellus</i>		X			X
Redbreast sunfish, <i>Lepomis auritus</i>		X			X
Redear sunfish, <i>Lepomis microlophus</i>		X			X
Pumpkinseed, <i>Lepomis gibbosus</i>		X			X
Cichlids (Cichlidae)					
Rio Grande cichlid, <i>Herichthys cyanoguttatus</i>		X			X
Perches (Percidae)					
Walleye, <i>Sander vitreus</i>		X			X
Yellow perch, <i>Perca flavescens</i>		X			X
Temperate basses (Percichthyidae)					
White bass, <i>Morone chrysops</i>		X			X
Striped bass, <i>Morone saxatilis</i>	X	X			X
White perch, <i>Morone americana</i>		X			X
Drums (Sciaenidae)					
Freshwater drum, <i>Aplodinotus grunniens</i>		X	X		
Cods (Gadidae)					
Atlantic cod, <i>Gadus morhua</i>	X	X	X		
Haddock, <i>Melanogrammus aeglefinus</i>		X	X		
Pollock, <i>Pollachius virens</i>		X	X		
Righteye flounders (Pleuronectidae)					
Winter flounder, <i>Pseudopleuronectes americanus</i>		X	X		
Mackerel (Scombridae)					
Atlantic mackerel, <i>Scomber scombrus</i>		X	X		
Lobster (Homaridae)					
American lobster, <i>Homarus americanus</i>	X	X	X		
Oysters (Ostreidae)					
Eastern oyster, <i>Crassostrea virginica</i>	X		X		
Number of species propagated in 1884	22		11	7	4
Number of species propagated in 1937		46	15	11	20

¹Names have been updated from the original sources to reflect current nomenclature (Nelson et al., 2004). Original sources for this Appendix are in U.S. Commission of Fish and Fisheries, Report of the Commissioner for 1884, House Misc. Doc. No. 68, 48th Cong., 1st sess., 1883–1884, p. XLVII–XLVIII (in PD 2245), and U.S. Department of Commerce, Bureau of Fisheries, Propagation and Distribution of Food Fishes: Fiscal Year 1937, Appendix IV to Report of the United States Commissioner of Fisheries for the Fiscal Year 1937 with Appendices (Gov. Print. Off., Wash., D.C., 1939), p. 463. Assignment of the species propagated into commercial, game, and combined categories has been made in conformance with common usage. Except in obvious cases, such as the cod (commercial) and the brook trout (game), the assessment of the relative sporting qualities of fish has been a traditional exercise in subjectivity among the "friends" of the species involved. The steelhead trout, a game fish of the first rank, is taken in commercial quantities on the Pacific coast and classified as combined. The pond fishes, such as the sunfish, deserve a special "recreation" category because they are of no commercial value and, except by small boys, are not considered as game varieties. They are shown here in the combined classification.

into United States waters in the 1870's were unsuccessful (U.S. Commission of Fish and Fisheries, 1878–79).

Anadromous Species

The propagation of Atlantic anadromous species by the Division was confined principally to American shad, *Alosa sapidissima*, and striped bass, *Morone saxatilis*. Small-scale efforts were continually made to restore the Atlantic salmon to waters from which they had been driven, like other species, by excessive fishing, pollution, and dams.

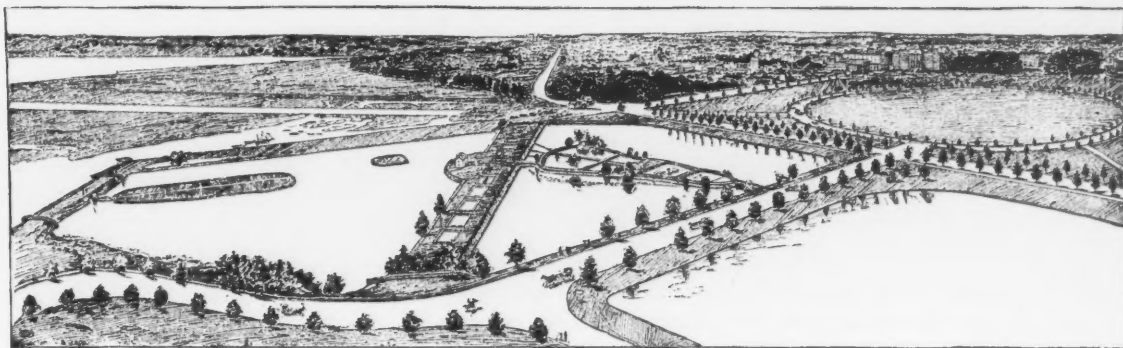
The shad was the specific object of the first appropriation for propagation in 1872, and it had been abundant in almost all of the coastal rivers of the eastern seaboard. The Division's fixed and mobile shad hatching stations intercepted the spring shad runs from the Carolinas to New England in a continuing effort to restore former numbers.

As with the cod, however, the enemies of the shad were more powerful than the efforts of the Fisheries Service to combat them. The Atlantic coast catch fell from 43 million pounds in 1892 to near 10 million pounds in 1941. Efforts on behalf of the Atlantic salmon resulted in maintaining a small but regular fishery in Maine's Penobscot River (Bureau of the Census, 1949).

Attempts at acclimatization of Atlantic anadromous species were more successful. Both the shad and the striped bass were introduced into the rivers of the Pacific coast, and by the late 1880's had established themselves as the foundations of valuable commercial and sport fisheries (U.S. Commission of Fish and Fisheries, 1888–89).

Freshwater Fishes

Propagation of interior commercial species by the Division of Fish Culture was accompanied by a steady effort to restore the principal food fish of the Great Lakes, round whitefish, *Prosopium cylindraceum*, and lake trout, *Salvelinus namaycush*. Operating out of stations in Ohio, Michigan, Minnesota, and New York with considerable state cooperation, the Division was able to help maintain, if not increase, the production of the Great Lakes fisheries.



Fisheries Service carp ponds, Washington, D.C. (ca. 1884) (The Century, 1884).

The annual catch from 1885 to 1939 ranged between 85 million and 115 million pounds.

The numbers of whitefish and lake trout declined, however, while the take of less valuable species rose. The Division abandoned whitefish production in 1940. Introduction of the steelhead trout, *Oncorhynchus mykiss*, and the chinook salmon, *Oncorhynchus tshawytscha*, of the Pacific coast into the Great Lakes was somewhat successful, but neither species attained commercial numbers. On the other hand, the carp, introduced in the 1870's, reproduced in numbers that exceeded market demand. Rainbow smelt, *Osmerus mordax*, stocked by accident in 1906, developed into an important fishery (U.S. Department of the Interior, 1940; Walford, 1947; Bureau of the Census, 1949).

Miscellaneous propagation efforts by the Division, though the smallest category in volume of fish produced, included some of the most interesting projects. The techniques developed for game fish propagation, notably the trouts and black basses, became the basis for the substantial stocking of recreational waters by the states as well as the Federal government. These techniques were characterized by the expensive but effective expedient of rearing young fish to fingerling or even greater size before planting.

Thus it was possible to provide trout fishing in many streams that would not support trout on a year-round basis by seasonal stocking of legal-sized fish.

The increased availability of basses and warmwater pond fishes, such as the sunfish, provided recreational fishing in thousands of lakes and farm ponds throughout the country. Many plantings of trout (Salmonidae) and bass (Serranidae) were unsuccessful, however, because the recipients introduced them into waters unsuitable for their survival.

Introduced Fishes

Acclimatization efforts with the trouts were very successful. The European brown trout, *Salmo trutta*, introduced from Germany in 1883, became a first-rate challenge to anglers, while the export of the rainbow trout, *Oncorhynchus mykiss*, to New Zealand resulted in spectacular sport fishing opportunities there. The rainbow trout was also widely and successfully distributed in other U.S. waters well beyond its native western habitat (Goode, 1884; Dall, 1915).

Among the coarse fishes, special mention should be made of the European carp, *Cyprinus carpio*, a staple food fish introduced there from China in the 13th century and long the object of intense aquaculture. Carp culture was an early and favorite project of the Division of Fish Culture. It was conducted with considerable publicity in the Washington, D.C., area including the ponds adjacent to the Washington Monument. The periodic "drawing of the ponds" was an event provoking some excitement in the city; and in the

winter the public was further delighted by the use of the shallow pools for ice skating.

Over 7,000 applications for carp were received by the Fish Commission in 1881. Though technically successful, the planting of carp was discontinued in 1906. By that time it was apparent that the now abundant species had limited market appeal and was of little interest to anglers. The ponds had also been utilized to propagate more exotic members of the carp family, and the Division was obviously relieved to announce that it would distribute no more goldfish to individuals at the end of the 1893 season (U.S. Commission of Fish and Fisheries, 1878-79, 1882-83; 1895-96; U.S. Department of Commerce and Labor, 1905-06).

Aquatic species other than finfish given the greatest attention by the Division were the oyster, *Crassostrea* spp., lobster, *Homarus americanus*, and freshwater mussel. Efforts with the oyster were primarily restricted to experimental oyster farming methods for the benefit of commercial oyster cultivators. Extensive studies were also made to identify and control the enemies of the oyster such as the starfish, *Asterias forbesi*, and the oyster drill, *Urosalpinx cinerea*, a tiny oyster-eating snail. The eastern oyster, *Crassostrea virginica*, was introduced on the Pacific coast with moderate success, while the Japanese (or Pacific) oyster, *Crassostrea gigas*, introduced into the same waters in the 1920's, quickly

became a commercial staple (Federighi, 1935; Walford, 1947).

Lobster Culture

Lobster propagation centered at a special facility which was constructed at Boothbay Harbor, Maine, in 1904. Because of exploitive fishing methods, Division efforts were unable to lift the annual catch from a plateau of 11 million pounds per year (down from an estimated 30 million pounds in 1889). In 1919, 80% of the lobstermen in one locality actually voted to disobey local lobster fishing regulations in order to benefit from the very high post-war prices. The Division, obviously discouraged, returned an appropriation for lobster rearing facilities to the Treasury. Repeated efforts to introduce the eastern lobster into Pacific waters were unrewarding (Bureau of Fisheries, 1921a; Walford, 1947).

Propagation of the freshwater mussel, the prime industrial source for mother-of-pearl, was carried out on an extensive scale at Fairport, Iowa, beginning in 1911. By 1930, however, pollution had nearly destroyed the fishery in the upper Mississippi River Basin and further propagation efforts on a smaller scale were shifted to San Marcos, Texas (U.S. Department of Commerce, 1930).

Propagation of the Pacific salmon began with Livingston Stone's adventures in California in 1872, and by 1915 it absorbed one-third of the annual appropriation for fish culture work. The expense was partly caused by the need to rear the young fish to predator-resistant size, and partly by the large scope of the operations. Working out of numerous stations in California, Oregon, Washington, and Alaska, the Division of Fish Culture was important in maintaining the salmon fisheries of the Pacific coast. The construction of the Bonneville and Grand Coulee Dams in the 1930's presented serious problems that were only partially solved by the expenditure of millions of dollars for fishways (Bureau of Fisheries, 1917a; U.S. Department of Commerce, 1937).

Acclimatization attempts with the Pacific salmon included a modest, if

short-lived, success and a marked failure. The short-lived success was the introduction of the humpback variety into a few Maine rivers. The failure was the attempt to plant the larger chinook in all major East Coast rivers. The project was stubbornly continued from 1872 until 1896. Shipments of fertilized chinook eggs were also sent to many European and Asian nations in efforts to acclimatize one of this country's most valuable commercial and game species (U.S. Commission of Fish and Fisheries, 1874, 1889-90; Goode, 1884; U.S. Department of Commerce and Labor, 1905-06; Bureau of Fisheries, 1917b, 1921c).

Effectiveness

In assessing the effectiveness of the work of the Division of Fish Culture it should be noted, in fairness, that natural and man-made antagonists to successful stocking programs were often beyond the Division's knowledge or control. Seldom willing to acknowledge deficiencies in basic scientific knowledge, the Fish Commissioners usually blamed their failures on dams, fishing methods, harmful water pollution, and state failures to enact or enforce adequate regulation. Even the enthusiastic Professor Baird had cautioned that "too much ... must not be expected from artificial propagation, ... In some cases the preventable difficulties ... successfully antagonize all efforts made" (U.S. Commission of Fish and Fisheries, 1882-83; Bureau of Fisheries, 1914).

The total expenditures of the Division of Fish Culture in the 69 years from 1872 through 1941 were about \$94 million, an average of \$1.4 million per year. This represented nearly 60% of the aggregate disbursements of all divisions of the Fisheries Service (in 1958 dollars).¹⁵ Prior to creation of the Alaska Division in 1912, the annual percentage spent for fish culture averaged closer to 70%, while after that date it declined to an average of 45% in the 1930's.

¹⁵ Valuations in this paragraph are in 1958 dollars. See Table 5 for Division of Fish Culture expenditures and Walford (1947) p. 127, for retail valuation of U.S. fisheries products in 1943.

During the 1930's, about \$2 million was allocated to fish culture annually. When evaluating Division accomplishments, it is significant to note that \$2 million was only about two-tenths of 1% of the annual retail valuation of the products of the United States fisheries, the latter figure an estimated \$1.05 billion in 1943. The Federal investment was certainly small enough to justify the Division's positive contributions with full allowance for the many programs that failed completely or were, in themselves, unable to check the decline of important fisheries.

Although the early enthusiasm for the potential of artificial propagation was eventually dampened by natural and human limitations, the accomplishments of the Division in the cause of conservation were greatly enhanced by their stimulation of state cooperation. Although relations were not always harmonious, the development of fruitful Federal-state cooperation in fishery conservation far exceeded the pessimistic predictions of the early Fish Commissioners, and it was made possible, in large part, by the example set by the Federal Service in sharing knowledge, dollars, and fish culture facilities for the public good.

Conversely, the rise of public concern for conservation and the upsurge of public participation in recreational fishing stimulated both Federal and state efforts in stocking programs, particularly those involving game species. Though difficult to measure, the impact of Federal fish culture on fostering sound public attitudes toward wildlife conservation may have been the greatest accomplishment of all.

The Alaska Fisheries Service

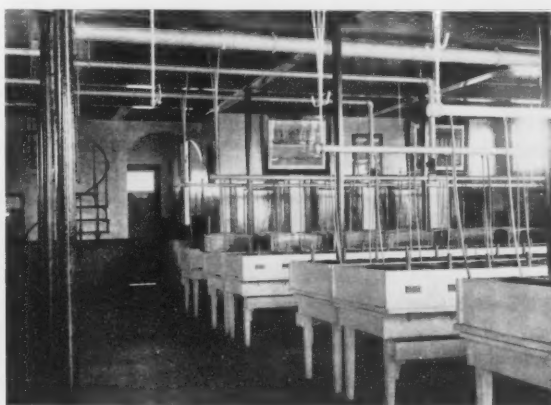
"The laudable desire of citizens of the Pacific coast to share in the prolific fisheries of the oceans, seas, bays, and rivers of the western world" (U.S. Congress, 1868) was among the important reasons given for the United States purchase of Alaska. Although the wisdom of that purchase has been almost incalculable in terms of mineral wealth and strategic value, the financial return from the Alaska fisheries has been ad-



Boothbay Harbor, Maine, hatchery overview in 1905, courtesy of the National Archives.



Boothbay Harbor, Maine, hatchery pumphouse and boiler in 1905, courtesy of the National Archives.



Equipment for McDonald automatic tidal boxes for hatching cod at the Boothbay Harbor, Maine, hatchery (U.S. Department of Commerce and Labor, 1908).



Berried lobsters taken from hatchery lobster pound (U.S. Department of Commerce and Labor, 1908).



Stripping lobsters at the Boothbay Harbor, Maine, hatchery, courtesy of the National Archives.

ditional evidence that, for \$7.2 million, Secretary of State William E. Seward closed one of the most beneficial U.S. real estate transactions on record.

The value of salmon fisheries alone to processors was calculated at about \$3 million in 1897 and \$32 million between 1878 and 1898. The annual value of this fishery rose to over \$50 million in 1918, a figure exceeded only occasionally through 1940 and never falling below \$20 million even at the nadir of the Depression in 1932. In addition, the fur seal harvests of the Pribilof Islands in the Bering Sea, a Federal monopoly since 1910, netted the Treasury a return of \$2.364 million between 1918 and 1941, according to one analyst's careful estimate. The fisheries industries of Alaska, including related processing such as canning, drying, and mild curing, became the territory's most valuable commercial resource (U.S. Commission of Fish and Fisheries, 1898-99; Bureau of Fisheries, 1921a; Tomasevich, 1943; Bureau of the Census, 1949).

The Federal government was directly responsible for the preservation and maintenance of the natural assets of the Alaska fisheries. Although the scientific and practical programs of the Fisheries Service furnished the primary means of control, good results would not have been possible without the mutual support of two other areas of Federal activity. These were international diplomacy and the promulgation and enforcement of fisheries regulations.

The unique characteristic of Federal regulation of the Alaska fisheries was the timely combination of all of the factors needed for adequate conservation practices. Such a combination was seldom possible when state jurisdiction over wildlife was paramount or if international disputes were of such rancor as to delay or prevent the setting up of joint control mechanisms. The history of the Alaska Fisheries Service was, in sum, a forceful demonstration of enlightened conservation, though punctuated with crises which often threatened to block or reverse significant progress.

The formation of the Alaska Fisheries Service as a division of the Bureau

of Fisheries in 1911 represented the maturing of Federal efforts on behalf of Alaska's fishery and fur resources that date back to 1868. Until 1903, the Treasury Department had maintained separate salmon and fur seal organizations. When the Department of Commerce and Labor was formed, both responsibilities were transferred to the jurisdiction of the Secretary, who assigned the salmon service to the Bureau of Fisheries in 1905 and the fur seal service to the same agency in 1908.

Responsibilities

In 1910 the Secretary also was entrusted by Congress with the care of other fur bearing animals, and this responsibility was promptly added to those already held by the Bureau of Fisheries. Although terrestrial animals were not the specialty of the Fisheries Service, the assignment was considered appropriate because it utilized the Bureau's extant Alaska Service's organization and thus avoided the creation of a duplicate administrative system. This move also unified government fur marketing activities.

The Alaska Fisheries Service was thus directly responsible for the conservation of all of Alaska's commercially valuable wildlife. Only the regulation of game animals was outside the Bureau's purview. That was the task of the Bureau of Biological Survey, a division of the Department of Agriculture (U.S. Congress, 1909-10a; Bureau of Fisheries, 1913).

Strict regulation of Alaska's salmon fisheries did not seem necessary prior to the rapid expansion of the canning industry in the late 1880's, because the abundance of the five species of Pacific salmon was almost incredible. These species were: the red, sockeye, or blueback, *Oncorhynchus nerka*; the king, chinook, or spring, *Oncorhynchus tshawytscha*; the coho or silver, *Oncorhynchus kisutch*; the pink or humpback, *Oncorhynchus gorbuscha*; and the chum, keta, or dog, *Oncorhynchus keta*.

The sockeye salmon was the most valuable to canners. In 1888 the Alaska

Commercial Company caught over 1.2 million sockeye by completely obstructing the Karluk River, and the next year the mouth of the Karluk was crowded with quickly constructed rival canneries. On 2 March 1889 Congress passed its first law designed specifically for the protection of salmon (U.S. Congress, 1888-89a, 1891-92).

Although data on the life histories of these salmon were still imperfect, enough knowledge had been gained through Fish Commission investigations dating back to 1872 in California to make plain that even partial obstruction of a spawning river could lead to the annihilation of its salmon population. The law of 1889 made dams, barricades, and other obstructions unlawful and subjected those who erected them to a fine of \$250 a day. Moreover, the law authorized the Commissioner of Fisheries to make a thorough investigation of the Pacific salmon and the methods of taking them for the purpose of making recommendations regarding the possibilities for artificial propagation and the passing of further appropriate legislation (U.S. Congress, 1888-89a).

The *Albatross* was sent to the Pacific in 1888 for this purpose, and the Commissioner made his report in 1892. One valuable result of the report was the establishment of the first Alaska Forest and Fish Cultural Reserve on Afognak Island. The argument for its establishment was well stated by the far-sighted but pessimistic Livingston Stone:

"I will say from my personal knowledge that not only is every contrivance employed that human ingenuity can devise to destroy the salmon of our west-coast rivers, but more surely destructive, more fatal than all is the slow but inexorable march of those destroying agencies of human progress, before which the salmon must surely disappear as did the buffalos of the plains. ..." (U.S. Congress, 1891-92, 1892).¹⁶

¹⁶ This established the Afognak Island Forest and Fish Culture Reservation.

The law of 1889 stood, however, until replaced by another in 1906 as the result of a major study inaugurated by President Theodore Roosevelt. By that time the difficulties of enforcing fisheries restrictions on 2,000 miles of coastline had become apparent, and the Bureau of Fisheries recommendations were accordingly supported.

Two important recommendations were:

- 1) that the regulation of the salmon fisheries be placed wholly in the expert hands of the Fisheries Service, and
- 2) that hatcheries be promptly built to revive and augment the salmon runs that had already been damaged by overfishing.

An important adjunct to the recommendation for Fisheries Service control was the granting of limited authority to the Secretary of Commerce and Labor to modify the salmon law without recourse to Congress as new conditions made such revisions expedient (U.S. Congress, 1904, 1904-05, 1905-06a).

Salmon Regulations

Salmon fisheries were regulated by executive order on the basis of the law of 1906 until the findings of a Presidential Commission of 1923 called for new legislation in order to put into effect the revisions shown to be necessary through 17 years of experience. In the meantime, the prerogative of Federal control over the wildlife resources of Alaska was carefully guarded by specifically denying such authority to the Territorial Legislature created in 1912.

New salmon legislation was passed in 1924. It explicitly sanctioned the setting aside of Federally controlled fishing areas, strengthened the measures prohibiting the building of obstructions and the use of nets and fish traps within specified distances of river mouths, and made a 50% "escapement" mandatory (U.S. Congress, 1911, 1923-24a; U.S. Department of Commerce, 1924).

Although the percentage was later modified for individual rivers and seasons, the concept of controlling the

numbers of fish that were permitted to "escape" upstream relative to the size of the run and the capacity of the spawning beds became the cornerstone of salmon conservation practice. As more knowledge of the fish and rivers was gained, the Fisheries Service was eventually able to predict with reasonable accuracy the size of future runs. This was a valuable service to the fishing industry.

Salmon regulation enforcement was a major concern of the Fisheries Service. The principal duty of regular inspection of fishing and canning operations was first undertaken by three Treasury agents in the summer of 1896. Under the Bureau of Fisheries the number of enforcement personnel grew markedly. In 1929, 228 men were so employed. These agents had the use of 14 Bureau vessels, 10 hired vessels, a number of small launches owned by temporary agents, and, for the first time, an airplane (U.S. Department of the Treasury, 1896-97; U.S. Department of Commerce, 1930).

Prior to enforcement of the law of 1906 by growing numbers of agents, disregard for the salmon laws was commonplace. Judicial processes were slow because of the infrequency of court sessions and the great distances often involved in bringing the accused before the judges. Nevertheless, the government was able to win the vast majority of its cases and gain the respect and cooperation of the industry. Alaska Indians and Eskimos were exempted from punishment when their traditional fishing methods conflicted with commercial regulations. The number of fish taken by the Natives was too small to have any significant effect on the outcome of the overall conservation program.

Salmon Culture

The second major recommendation, maintaining and augmenting the natural supply of salmon through fish culture, was speedily endorsed by Congress, and funds were made available in 1906 for the construction of Federal facilities at Yes Bay and Afognak Island. These hatcheries became operational in 1907 and 1909, respectively, and shared fish

cultural work with a small number of private hatcheries owned by the canning interests. Private fish culture was stimulated by the practical expedient of granting a 40-cent tax rebate per 100,000 salmon fry released. It was deducted from the Federal levy on canned salmon at the producer's level (U.S. Congress, 1904-05; U.S. Department of Commerce, 1936).

By 1911 the question arose as to whether salmon could be increased more efficiently through fish culture or through protection during natural spawning by regulation of fishing methods. That year's administrative report for the Alaska fisheries went so far as to state:

"It is not improbable that a general undervaluation of natural productivity and a corresponding overestimate of the results to be expected from hatchery work is responsible for the one time widely diffused belief that the presence of a few hatcheries would cure all the ills of an unremitting pursuit of salmon; while, now that the few hatcheries in operation do not seem to accomplish this miracle, the opposite tendency to decry all hatchery work is supplanting the former extreme optimism (Bureau of Fisheries, 1913).

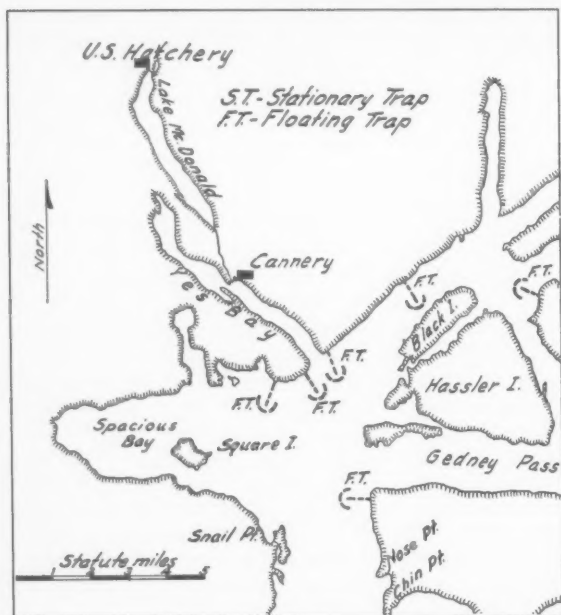
Natural Production

The relative strength of natural vs. hatchery fry was also questioned. The debate was ultimately resolved in favor of natural spawning, and Federal propagation activities were discontinued after the output of the 1932 season had been distributed. The last private hatchery ceased operations in 1936 (Bureau of Fisheries, 1936, 1939).

The new emphasis brought more elaborate efforts to increase the natural productivity of the salmon. Since it was found that excess "escapement" overcrowded the spawning areas and added nothing to the size of the run when that particular generation returned to the river, any increase in the spawning area achieved by human means would increase productivity. Extensive stream



Afognak, Alaska, hatchery buildings (Jones, 1914).



Yes Bay, Alaska, hatchery, located at the head of McDonald Lake (Jones, 1914).



Yes Bay, Alaska, hatchery buildings (Jones, 1914).

improvements were undertaken such as the blasting of natural obstructions to the ascent of the fish to new spawning areas further upstream.

Regulations were enforced which kept the spawning beds free from chemical pollution and from the gumming effects of sawmill wastes. An important effort was also made, with the help of funds from the Territorial Legislature, to eliminate large numbers of Dolly Varden trout, *Salvelinus malma*, which shared the rivers with the salmon and fed voraciously on salmon spawn and fingerlings (Bureau of Fisheries, 1913, 1919, 1939).

The Fisheries Service's option to put its main effort behind natural spawning rather than propagation was available because only in Alaska had the government achieved effective regulatory control over the salmon fisheries. Such a control was more elusive in international waters and became a special problem in Canadian-American relations.

International Agreements

In this latter connection a dispute arose over the conservation of the sockeye salmon fishery of Canada's Fraser River system, a fishery which was being depleted by both nations. A sockeye salmon convention agreed upon by both nations in 1930 was finally ratified by the United States in 1937 (Convention for the Protection, Preservation and Extension of the Sockeye Salmon Fishery of the Fraser River System). Regulation of the fishery became the responsibility of an international commission for a period of 16 years. The basic problem of the commission was to identify and control the proper "escapement" into the system (Tomasevich, 1943).

Another important international fisheries agreement was concluded in 1930 which involved the valuable Pacific halibut, *Hippoglossus stenolepis*, fishery. Discussions between the United States and Canada, beginning in 1918, resulted in an agreement in 1923 (Pacific Halibut Convention) to prohibit fishing during the spawning season and to set up the International Fisheries Commission to study means for further conservation of the fishery.

In 1930 the two nations further agreed to a system under which the maximum halibut catches in three designated fishing grounds were assigned annually. National shares were determined on the basis of competition between the respective fleets, and fishing ceased when the maximums were reached. About three fish were taken by American fishermen for each one caught by the Canadians. Such problems as resulted from the agreement concerned the fisheries' flexibility in expanding and contracting their operations in accordance with the maximums. The rebuilding of a seriously depleted natural resource was thus accomplished (Tomasevich, 1943).¹⁷ Federal Fisheries Service personnel thus made important contributions to the international control commissions that resulted from both the halibut treaty (International Pacific Halibut Commission) and the sockeye convention (International Pacific Salmon Fisheries Commission).

Salmon Pack

The success of Federal efforts to regulate the fisheries for salmon and other commercial fish in Alaska waters was apparent in the statistics of the catches. The annual salmon "pack" of case units containing 48 1-lb cans or the equivalent weight in smaller tins, rose from 36,000 cases in 1883, to 611,000 in 1890, and to 2 million in 1902.

Though subject to downward fluctuations from seasonal variations in fish abundance and market shrinkage in the depression years, the annual pack continued to rise sharply to over 6.6 million cases in 1918. In that year over 100 million salmon were taken. After the post-war depression the pack resumed its increase and averaged over 6 million cases through the 1931-41 decade. The record year was 1936 when over 8.4 million cases were packed and over 129 million salmon were taken.

The take of the valuable sockeye increased in absolute numbers over the entire period but fell as a percentage of

the pack. The overall growth of the pack was made possible by greater utilization of other salmon species, notably pink and chum (U.S. Congress, 1891-92; Bureau of Fisheries, 1921a, 1939; Tomasevich, 1943).

The success of international control over the Pacific halibut fishery is best demonstrated by the production record of the area south of Cape Spencer, off the southeast coast of Alaska. The catch from these grounds dropped from over 60 million pounds in 1912 to under 30 million pounds in 1917.

The industry responded to this situation by sharply increasing the intensity of its fishing efforts. The number of "skates" (set lines) employed rose from 309,000 in 1918 to a peak of 653,000 in 1929 and forced up the take slightly to 37 million pounds in 1921. Thereafter the grounds were so depleted that the record 1929 effort produced only 26 million pounds. The international agreements reached in 1923 and 1930 enabled these grounds to continue to produce between 20 and 30 million pounds annually from 1923 through 1941 with a reduction in the number of "skates" at the end of the period to a more efficient 390,000 (Tomasevich, 1943).

Production from the newer halibut grounds west of Cape Spencer was brought under control before the grounds were seriously depleted. By the middle 1920's this area rivaled the southern grounds in the numbers of fish taken. Farther from the fishing ports than the southern area, the western grounds were not heavily fished until the introduction of the diesel engine into commercial fishing vessels between 1921 and 1923 made the run profitable. The efficiency of the diesel engine also accounted for the willingness of the industry to increase the number of "skates" on the southern grounds even though the catch per "skate" fell from 271 pounds in 1910 to a low of 35 pounds in 1930 (Tomasevich, 1943).

The salmon and halibut fisheries of Alaska would have been seriously depleted or commercially exhausted without well enforced, scientifically grounded regulations. The Federal gov-

ernment, working through the Fisheries Service and international diplomacy, deserves great praise for its sound record of accomplishment in maintaining these resources.

Fur Seal Restoration

The rescue of the fur seal herd of the Pribilof Islands was a dramatic example of the value of enforced conservation principles. When the Bureau of Fisheries was made responsible for the preservation and increase of the herd in December 1908, the condition of the fur seal fishery was "little less than a national disgrace" (U.S. Department of Commerce and Labor, 1909).

Estimated at 2 million or more seals at the time of the Alaska purchase, the herd, numbering less than 140,000 animals, was approaching extinction. The cause of the decline was pelagic sealing, the killing of seals in the open sea en route to or from their island breeding grounds.

Conducted under conditions of fierce international competition, pelagic sealing resulted in the indiscriminate slaughter of cows as well as bulls with the consequent starvation of motherless pups. Careful control of the land kill by the government according to sound principles of conservation could not compensate for the damage done at sea.

Pelagic sealing had been on the increase since the 1880's despite strenuous efforts of the State Department to control it from 1887 onward. In 1896, the House of Representatives, frustrated by repeated diplomatic failures and armed with proof of the dangers of pelagic sealing furnished by an Anglo-American study (Baden-Powell and Dawson, 1893; Behring Sea Commission, 1893), went so far as to pass a resolution (later shelved by the Senate) providing for the deliberate killing of the entire herd by the United States if the other interested powers did not come to an agreement. This action was directed at Great Britain, Japan, and Russia (Tomasevich, 1943).

American pelagic sealing interests were also uncooperative, some operating under the Japanese flag so they

¹⁷ See column 2, this page, for growth statistics of the halibut fishery.

could move to the 3-mi limit off the Pribilofs. American and Canadian vessels were compelled by international law to observe a 60-mi limit after 1893. In 1897 the United States unilaterally forbade pelagic sealing to its own nationals (Tomasevich, 1943).

High market prices for the dwindling supply of prime seal skins engendered spirited evasion of the laws. For example, raids by armed poachers on the Pribilof rookeries in 1906 were repulsed by Bureau of Fisheries personnel with a loss of five lives among the raiders and

the imposition of a dozen jail sentences (U.S. Department of Commerce and Labor, 1906-07).

Fur Seal Convention

Finally, in 1911, when the extinction of the herd appeared imminent, a workable arrangement was reached under which pelagic sealing was prohibited to the nationals of Japan, Russia, Canada, and the United States in return for assigned shares, in hides or cash, from the annual land kill conducted on the islands by the United States. Without

the benefit of this North Pacific Fur Seal Convention of 1911, subsequent efforts of the Bureau of Fisheries would have been useless (Tomasevich, 1943).

The land kill prior to 1910, though supervised by the government, had been carried out by two private organizations: the Alaska Commercial Company from 1870 to 1890, and the North American Commercial Company from 1890 to 1910. Upon leasing the islands, both received a seal harvest monopoly subject to annual quotas. In return, the companies paid an annual rent and a royalty per hide and provided for the maintenance and education of the few hundred natives on the two islands.

When the second lease expired, Congress made the taking of seals on land a pure government monopoly. This move enabled the United States to conclude a workable international agreement and to avoid complaints of favoritism from the angry pelagic sealing lobby (Tomasevich, 1943).

Pribilof Operations

The Bureau of Fisheries took full operational control of the Pribilofs on 21 April 1910. This included the management of the fur seal herd, the blue and white foxes on the islands, and the sustenance, shelter, and education of the native population. Since the enabling legislation also made the Bureau responsible for the regulation of commercial furbearers throughout Alaska, a fur warden force was established in 1911. Policy in that area soon included the leasing of small uninhabited islands for the purpose of fox farming (Bureau of Fisheries, 1913, 1921c).

The Bureau also attempted to develop economic uses for the byproducts of the seal fishery, although these efforts never became commercially significant. A cold storage plant was built in 1916 and a more elaborate byproduct facility was added in 1930. Seal oil was processed for sale on the open market, while some of the meat was utilized for fish food by the Division of Fish Culture, and some formed a supplement for fox feeding during the winter. The bone deposits left on the islands by decades of seal drives were converted into saleable fertilizer



Fur seal rookeries, St. Paul Island, Alaska, courtesy of the National Archives.



Pelagic sealer boarded by *Albatross* staff to collect statistics in 1895, courtesy of the National Archives.

(U.S. Congress, 1914–15; Bureau of Fisheries, 1919; U.S. Department of Commerce, 1930; Tomasevich, 1943).

The monotonous routine on the remote Bering Sea islands presented some special personnel problems. "Demoralization" during the winter of 1913–14 resulted in the "reorganization" of the Bureau's force on the larger island of St. Paul. The agent, the caretaker, and the storekeeper were replaced, and the natives were subjected to "much-needed restraint, especially in the making and using of intoxicating liquors" (Bureau of Fisheries, 1917a).

Fur Seal Increase

Such difficulties were minor, however, for the Pribilof herd showed a steady increase in numbers after pelagic sealing was finally stopped by the agreement of 1911. The season of 1912 was the first that was completely free from killing at sea, and, by 1941, the herd comprised over 2 million animals, a figure that approximated the size of the herd in 1867 at the time of the purchase of Alaska. So effective were the Bureau's efforts to rebuild this resource that the major concern shifted from increasing the herd to maintaining it at an economic maximum that would not break prices on the fur market because of an overabundant supply. Over a million skins were taken from the herd between 1918, when commercial killing for the Government's account was officially begun, to the end of the summer killing season in 1941. The sale of these skins brought the Government a net profit of nearly \$2.5 million (Tomasevich, 1943; Walford, 1947).

From fiscal year 1912 through fiscal year 1941 the Alaska Division of the Federal Fisheries Service expended nearly \$22 million, an annual average of about \$716,000 and 19% of the total Fisheries Service budget over that 30-yr period. Table 6 lists expenditures of the Alaska Division.¹⁸ This figure does not include earlier Federal expenditures through the Departments of the Treasury

and Commerce and Labor, nor does it include Fisheries Service expenditures on Alaskan hatchery operations (U.S. Congress, 1904–05, 1906–07).¹⁹

About 60% of the Division's appropriations went into a general Alaska service account which, in turn, was largely devoted to the community on the Pribilofs. Other small portions went to pay the salaries of temporary enforcement personnel and the costs of rented vessels. The remaining 40% went for the salaries of the statutory Bureau personnel and included construction costs of new vessels for the Alaska operations.

A measure of the growth and scope of enforcement responsibility and of the vastness of the area under surveillance was indicated by the changing proportion of vessel crew salaries in the divisional budget. In 1916, 13% of the budget was so spent compared to 23% for other statutory personnel. After 1925, the relative position of these two groups was reversed, and in 1940, 22% of the \$782,000 budget went to vessel crews while only 22% went to other permanent personnel.

Overall vessel costs for the Division ran to a conservatively estimated 25% of its budget over the 30 years from 1912 through 1941, not including the services of the *Albatross* in Alaska waters. Vessel costs for the Fisheries Service as a whole over the same period averaged only 12%.

The efforts of the Federal Fisheries Service to maintain the fisheries resources of Alaska, reinforced by effective international agreements, were a great success by any standard. The dollar costs to the taxpayer have been an infinitesimal fraction of the value of the natural resources they have preserved and, as in the case of the seals, increased. The combination of scientific knowledge and well drawn, effectively enforced legislation has been an almost

model demonstration of sound conservation practices, and has provided the best example of what the Fisheries Service could accomplish when unencumbered by the frequent jealousies of state interests.

Summary and Appraisal

The Federal Fisheries Service, comprising the originally independent U.S. Fish Commission, the Bureau of Fisheries and, finally, the component of the Fish and Wildlife Service as of 1941, evolved and performed within the complex environment of an industrial nation, where rapid growth subordinated the conservation of fisheries to short-term gain and threatened the survival of this initially abundant and increasingly valuable resource. A scientific agency with well conceived programs of action, the Fisheries Service provided knowledge, advice, and example to state governments and individuals with fishing interests, whose adherence to traditional fishing practices and legal prerogatives often impaired the vision and discipline imperative for the maintenance of natural resources held in common. In many cases the efforts of the Fisheries Service were supported by timely international agreements which constituted the precedent for Federal interest in fishery matters.

Relying on the cooperation of state governments for the execution of sound conservation practices in waters under state jurisdiction, the Fisheries Service earned stature as an advisor through heavy emphasis on basic biological research. The lack of such knowledge was marked and universal in the 1870's. Yet, toward the end of the decade the situation was much improved through the initiative and enthusiasm of naturalist and administrator Spencer F. Baird, founder of the Fish Commission.

Through the Division of Scientific Inquiry, research activity was carried on cooperatively with prominent private specialists both in this country and abroad. Biological stations and vessels like the *Albatross* were constructed for research purposes. Together, men and the facilities made important additions to the sum of human knowledge and,

¹⁸Valuations in this and the following paragraph are in terms of 1958 dollars. See Table 6 for expenditures of the Alaska Division.

¹⁹The Bureau of Fisheries spent about \$1.3 million in Alaska before the Alaska Division was formed (1904–11). The hatcheries at Yes Bay and Afognak Island cost \$225,000 to construct and required annual salary payments of \$41,000 from 1919 through 1932 while both were in operation.

in doing so, derived the principles of conservation which were the vital bases for effective regulatory legislation. The quality of the research work of the Fisheries Service was excellent and of enduring value.

In support of its recommendations, and as a service to international diplomacy and to the fishing industry, the Fisheries Service assumed responsibility for the gathering and dissemination of fishery statistics. This function was ably performed by the Division of Fisheries, which also experimented with the methods of taking fish and the processing of fisheries products. The cooperation of this Division with the fisheries industries grew to be close, and its services approximated those of a trade association. Yet few efforts to develop and promote fisheries products were successful. Even a combination of public and private merchandising efforts was unable to alter the public's basic preference for foods other than fish when a choice was available.

Through the Division of Fish Culture, the Fisheries Service attempted to counterbalance destructive fishing methods and inadequate regulations by artificial propagation and acclimatization programs. Politically popular, such efforts gathered momentum despite numerous failures which demonstrated that their value, though substantial, had been overrated and that depleted fisheries could not be restored without the assistance of sound, well enforced regulatory legislation.

The Division of Fish Culture, through example and the development of cooperative fish culture programs, was an important stimulus to state and private hatchery operations (U.S. Department of Commerce, 1931).²⁰ The raising and stocking of fish for recreational purposes at public expense grew from a token status to become a popular, major program on both Federal and state levels. The preponderance of eggs and

fry released, however, remained those of commercial species. As the largest, most publicized Federal fisheries effort, the work of this Division made its outstanding contribution by fostering enlightened public attitudes toward the conservation of fisheries resources.

The showcase of applied conservation principles was the Territory of Alaska, where the Federal Fisheries Service enjoyed direct regulatory jurisdiction over commercial fish and fur resources. Buttressed by international agreements, the Fisheries Service rescued the fur seal herd of the Pribilof Islands from commercial extinction and was able to maintain and temporarily increase the abundance of Pacific salmon, Alaska's most valuable commercial resource.

From fiscal year 1871 through 1941, the Federal Fisheries Service expended approximately 53 million current dollars of the taxpayer's money, \$35 million of which was channeled through fish culture programs (see Tables 2 and 5). The return on this investment in fishery resources was a substantial addition to the national wealth by any standard of measurement. Considered, for example, as the major portion of the research budget of the fishery industry, the average annual expenditure of the Fisheries Service on all its programs amounted to 2.4 million 1958 dollars; a figure amounting to only two-tenths of 1% of the added value of the products of the fishing industry in the year 1943.

Conservation efforts were frequently too late or insufficient to prevent the decline of many fisheries in the path of "the destroying agencies of human progress." Nevertheless, in most instances the Fisheries Service was successful in maintaining the numbers of fish at a commercially profitable level, and the value of this accomplishment more than offset losses incurred by disappointing fish culture and acclimatization projects. In this context, occasional increases in abundance could be considered both as extra dividends to the fisheries industries and as additions to the priceless asset of a ready food supply in time of crisis.

Finally, events have vindicated Professor Baird's vision of the Federal gov-

ernment as the source of scientifically based advice and action for the purposes of maintaining the nation's fishery resources. Though sometimes impeded by forces beyond its jurisdiction or control, the Federal Fisheries Service, during 1871-1940, efficiently performed the tasks of enhancing the preservation of the nation's fishery resources and of fostering public consciousness of the importance of wildlife conservation in urban, industrial America.

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²⁰In 1931 the 88 permanent Federal hatcheries were about one-third of the total number of hatcheries operating in the United States and its possessions, while 119 state and private fish nurseries were raising Federally donated fish with their own funds and facilities.

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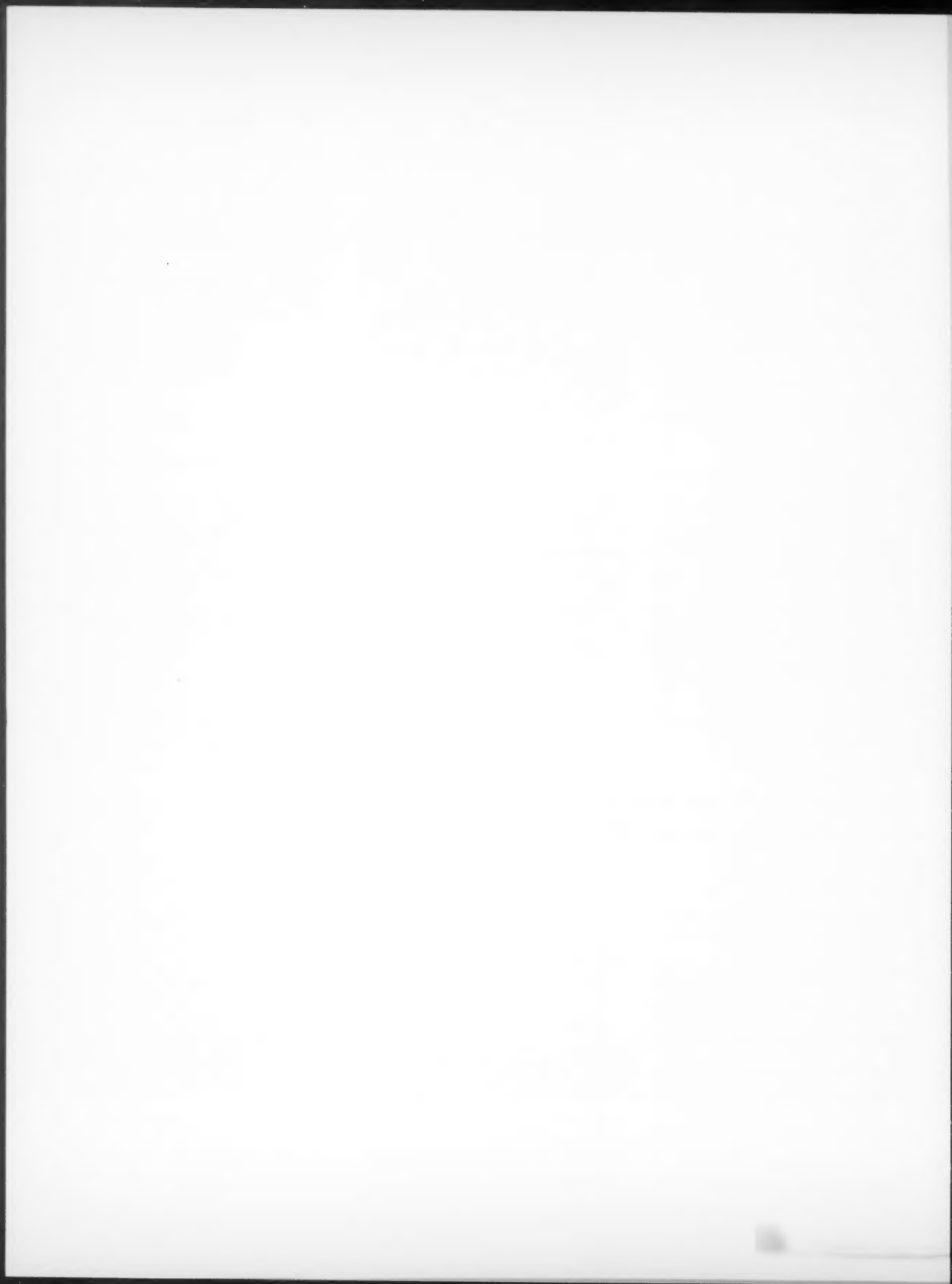
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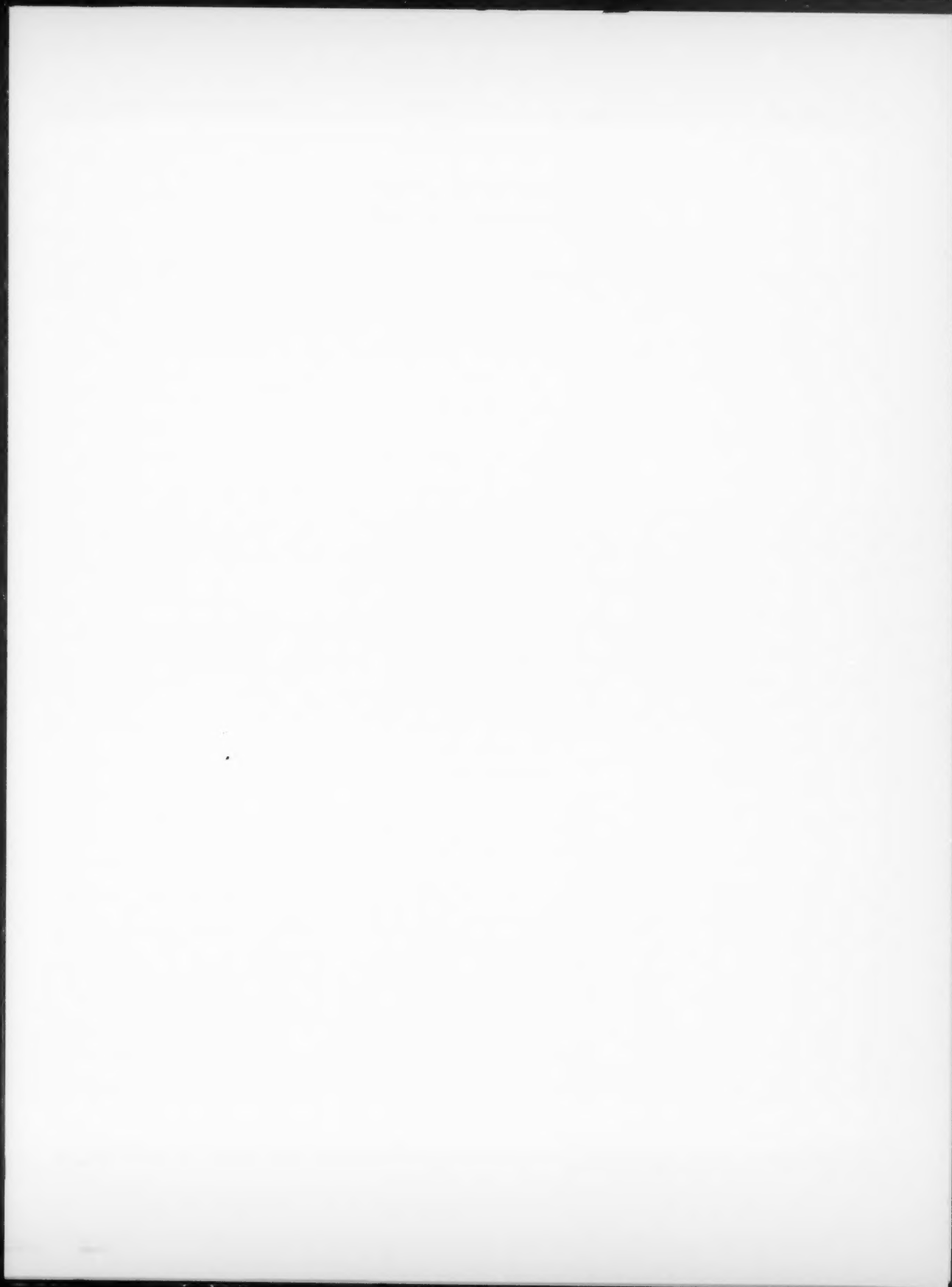
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Editorial Guidelines for the *Marine Fisheries Review*

The *Marine Fisheries Review* publishes review articles, original research reports, significant progress reports, technical notes, and news articles on fisheries science, engineering, and economics, commercial and recreational fisheries, marine mammal studies, aquaculture, and U.S. and foreign fisheries developments. Emphasis, however, is on in-depth review articles and practical or applied aspects of marine fisheries rather than pure research.

Preferred paper length ranges from 4 to 12 printed pages (about 10-40 manuscript pages), although shorter and longer papers are sometimes accepted. Papers are normally printed within 4-6 months of acceptance. Publication is hastened when manuscripts conform to the following recommended guidelines.

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Submission of a manuscript to *Marine Fisheries Review* implies that the manuscript is the author's own work, has not been submitted for publication elsewhere, and is ready for publication as submitted. Commerce Department personnel should submit papers under a completed NOAA Form 25-700.

Manuscripts must be typed (double-spaced) on high-quality white bond paper and submitted with two duplicate (but not carbon) copies. The complete manuscript normally includes a title page, a short abstract (if needed), text, literature citations, tables, figure legends, footnotes, and the figures. The title page should carry the title and the name, department, institution or other affiliation, and complete address (plus current address if different) of the author(s). Manuscript pages should be numbered and have 1½-inch margins on all sides. Running heads are not used. An "Acknowledgments" section, if needed, may be placed at the end of the text. Use of appendices is discouraged.

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Keep titles, heading, subheadings, and the abstract short and clear. Abstracts should be short (one-half page or less) and

double-spaced. Paper titles should be no longer than 60 characters; a four- to five-word (40 to 45 characters) title is ideal. Use heads sparingly, if at all. Heads should contain only 2-5 words; do not stack heads of different sizes.

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In style, the *Marine Fisheries Review* follows the "U.S. Government Printing Office Style Manual." Fish names follow the American Fisheries Society's Special Publication No. 12, "A List of Common and Scientific Names of Fishes from the United States and Canada," fourth edition, 1980. The "Merriam-Webster Third New International Dictionary" is used as the authority for correct spelling and word division. Only journal titles and scientific names (genera and species) should be italicized (underscored). Dates should be written as 3 November 1976. In text, literature is cited as Lynn and Reid (1968) or as (Lynn and Reid, 1968). Common abbreviations and symbols such as mm, m, g, ml, mg, and °C (without periods) may be used with numerals. Measurements are preferred in metric units; other equivalent units (i.e., fathoms, °F) may also be listed in parentheses.

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